Proposed C Battery Limit

Battery	SIP (daily)						NESHAP (30-day avg)					
	Limit	Exceedances using 2006 - 2008					Limit	Exceedances using 2006 - 2008				
		7	8	9	13	14		7	8	9	13	14
Doors - draft	5%	1	1	3	5	0	2.5%	0	0	0	0	0
Doors - proposed	2%	6	15	23	23	8	1.75%	9	9	16	17	0
Lids - draft	1%	1	1	0	1	1	0.4%	0	0	0	0	0
Lids - proposed	0.6%	3	4	0	2	2	0.11%	0	0	0	0	0
Offtakes - draft	4%	5	8	13	4	5						
Offtakes - proposed	3%	6	12	23	9	7						

Conclusions

The submitted modeling for the proposed C Battery with the shutdown of Batteries 7-9 was found to be complete and technically accurate. Supplemental modeling performed by ACHD showed nearly identical results to the submitted modeling.

The proposed modification leads to negative impacts for all pollutants on a long-term basis. On a short-term basis, $PM_{2.5}$ shows positive but less than significant impacts, while short-term PM_{10} and SO_2 impacts are significant in the Lincoln Borough area. Maximum short-term impacts and significant levels are given below.

Pollutant Standard	Maximum Impact ($\mu g/m^3$)	Significant Level ($\mu g/m^3$)
PM10 24-Hour	6.516	5
SO2 24-Hour	13.918	5
SO2 3-Hour	62.608	25

The area surrounding the U.S. Steel Clairton Works is in attainment for PM_{10} and SO_2. Therefore, the proposed modification is not subject Prevention of Significant Deterioration (PSD) but must assure attainment of the National Air Quality Standards (NAAQS).

For comparison to the NAAQS, the maximum short-term impacts were added to the highest recorded 24-hour values in 2002 from the surrounding monitor sites (Lincoln, Liberty, Glassport). Results are shown in the table below.

Pollutant Standard	Maximum Impact ($\mu g/m^3$)	Maximum Monitored Concentration ($\mu g/m^3$)	Location of Maximum Concentration	Impact + Max. Monitored Concentration ($\mu g/m^3$)	NAAQS Standard ($\mu g/m^3$)	Exceedance of NAAQS
PM10 24-Hour	6.5	129	Lincoln	136	150	No
SO2 24-Hour	13.9	146	Glassport	160	365	No
SO2 3-Hour	62.6	384	Glassport	447	1300	No

The additional impacts due to C Battery would not have caused an exceedance of the NAAQS under worst-case 2002 conditions. Since the worst-case values involve modeled impacts and monitored concentrations that occur on different days and locations, and since long-term monitored PM_{10} and SO_2 levels show decreasing trends, actual future concentrations would likely be lower than the levels shown above.

The ACHD Planning and Data Analysis section approves of the modeling submitted for the proposed C Battery installation. Copies of the modeling input and output files are available from ACHD by request.

Monitored 2002 Comparisons

Actual monitored results from 2002 were examined for comparison to the criteria pollutant 24-hour modeled results. Overall 2002 air quality levels were average in relation to previous and following years' data. The highest modeled days for $PM_{2.5}$, PM_{10}, and SO_2 occurred on low-to-medium monitored days (i.e., good-to-moderate AQI levels).

The top five modeled days are displayed below by pollutant. Maximum impacts often occur at different receptors on the same day. For example, the top five Liberty $PM_{2.5}$ impacts all occurred on 11/08/02, so only this date is listed in the table below.

High Modeled Liberty PM2.5 Days	Liberty Monitored Concentration ($\mu g/m^3$)	High Modeled Clairton PM2.5 Days	Clairton Monitored Concentration ($\mu g/m^3$)
11/08/02	25.7	5/20/02	8.2
		7/31/02	20.1

High Modeled PM10 Days	Glassport Monitored Concentration ($\mu g/m^3$)	Lincoln Monitored Concentration ($\mu g/m^3$)	Liberty Monitored Concentration ($\mu g/m^3$)
3/23/02	11	41	11
2/9/02	32	58	35
10/2/02	33	53	48

High Modeled SO2 Days	Glassport Monitored Concentration ($\mu g/m^3$)	Liberty Monitored Concentration ($\mu g/m^3$)
6/24/02	46.5	36.6
1/28/02	97.4	75.8
6/10/02	125.1	33.9
1/27/02	58.3	112.3

Modeled Differential Impacts

ACHD verified the modeled results for criteria pollutants and selected air toxics using both the CALPUFF default post-processors and the supplied E²M-designed post-processor programs. The CALPUFF default post-processor total impacts (not individual impacts) are given in the tables below.

Impact Ranking	Liberty PM2.5 Annual ($\mu g/m^3$)	Liberty PM2.5 24-Hour ($\mu g/m^3$)	Clairton PM2.5 Annual ($\mu g/m^3$)	Clairton PM2.5 24-Hour ($\mu g/m^3$)
1st-High	-0.920	2.698	-0.504	1.321
2nd-High	-0.960	2.485	-0.519	1.292
3rd-High	-0.962	2.331	-0.528	1.287
4th-High	-1.011	2.238	-0.538	1.230
5th-High	-1.013	2.033	-0.546	1.212

Impact Ranking	PM10 Annual ($\mu g/m^3$)	PM10 24-Hour ($\mu g/m^3$)	SO2 Annual ($\mu g/m^3$)	SO2 24-Hour ($\mu g/m^3$)	SO2 3-Hour ($\mu g/m^3$)
1st-High	-0.106	6.516	-0.090	13.918	62.611
2nd-High	-0.119	6.488	-0.105	13.247	50.582
3rd-High	-0.158	5.396	-0.106	12.031	45.590
4th-High	-0.307	5.216	-0.127	11.994	43.791
5th-High	-0.334	5.140	-0.132	11.988	43.479

Impact Ranking	Benzene Annual (ng/m^3)	Toluene Annual (ng/m^3)	Xylene Annual (ng/m^3)	Napthalene Annual (ng/m^3)
1st-High	-0.387	-0.017	-0.002	-0.402
2nd-High	-0.451	-0.024	-0.003	-0.416
3rd-High	-0.456	-0.026	-0.004	-0.431
4th-High	-0.536	-0.026	-0.004	-0.441
5th-High	-0.568	-0.027	-0.004	-0.442

For PM2.5, ACHD modeling using the default CALPUFF programs produced identical results to the submitted modeling results from the E²M post-processors. Negligible differences were observed for short-term PM10 and SO2 impacts (± 0.005 $\mu g/m^3$) and for annual air toxics impacts (± 0.001 ng/m^3), most likely due to rounding differences between the different post-processors.

All annual impacts were less than zero. Only short-term PM10 and SO2 maximum impacts were above levels of significance.

Source Emission Rates

The table below shows the modeled emission rates for criteria pollutants and selected air toxics. These emission rates represent aggregates of some sources (e.g., battery fugitives) that were provided in the modeling submittal.

Area sources such as coal and coke wind erosion are the same sources for both C Battery and Batteries 7-9 (but at different rates); only the differential emission rates (C minus 7-9) for these sources are shown in the table.

Source	PM2.5 (lb/hr)	PM10 (lb/hr)	SO2 (lb/hr)	Benzene (lb/hr)	Toluene (lb/hr)	Xylene (lb/hr	Napthalene (lb/hr)
C Battery Combustion	3.7989	3.8468	20.9813	0.0381	---	---	0.1041
Quench C	23.4614	24.0934	2.9226	---	---	---	0.0452
C Battery PEC Baghouse	1.4014	3.3986	13.5760	0.0397	---	---	0.0029
C Battery Fugitives	11.5507	18.0171	14.0897	0.0726	0.0052	0.0007	0.0264
Ball Mill C	0.0039	0.0039	---	---	---	---	---
Loadout C	0.0251	0.0890	---	---	---	---	---
Coke Screening C	0.0342	0.1073	---	---	---	---	---
Coke Piles	0.1256	0.1256	---	---	---	---	---
Coal Piles	0.3539	0.3539	---	---	---	---	---
Pulverizer 1 Primary	0.0023	0.0114	---	---	---	---	---
Continuous Unload 1	0.0023	0.0069	---	---	---	---	---
Clamshell Unloader	0.0023	0.0046	---	---	---	---	---
Coal Transfer	0.0023	0.0091	---	---	---	---	---
Coke Transfer	0.1713	0.1713	---	---	---	---	---
Battery 7 Combustion	-9.3502	-9.3947	-7.8692	-0.0167	---	---	-0.0454
Battery 8 Combustion	-5.9664	-6.0870	-7.6411	-0.0167	---	---	-0.0454
Battery 9 Combustion	-5.2521	-5.3400	-7.8692	-0.0167	---	---	-0.0454
Quench 3 (Batt. 7-9)	-56.7682	-67.8046	-2.3660	---	---	---	-0.0463
Batt. 7-9 PEC Baghouse	-0.7982	-1.6511	-11.5388	-0.0390	---	---	-0.0028
Batt. 7-9 Fugitives	-17.7411	-27.2565	-24.6247	-0.1272	-0.0094	-0.0013	-0.0479
Ball Mill, Loadout, Screening (Batt. 7-9)	-0.0514	-0.1611	---	---	---	---	---

C Battery Locations

Below is an aerial map showing the key modeled locations of proposed C Battery sources.

Proposed C Battery Source Locations

Quench Tower

Combustion Stack

Battery Line

Baghouse Stack
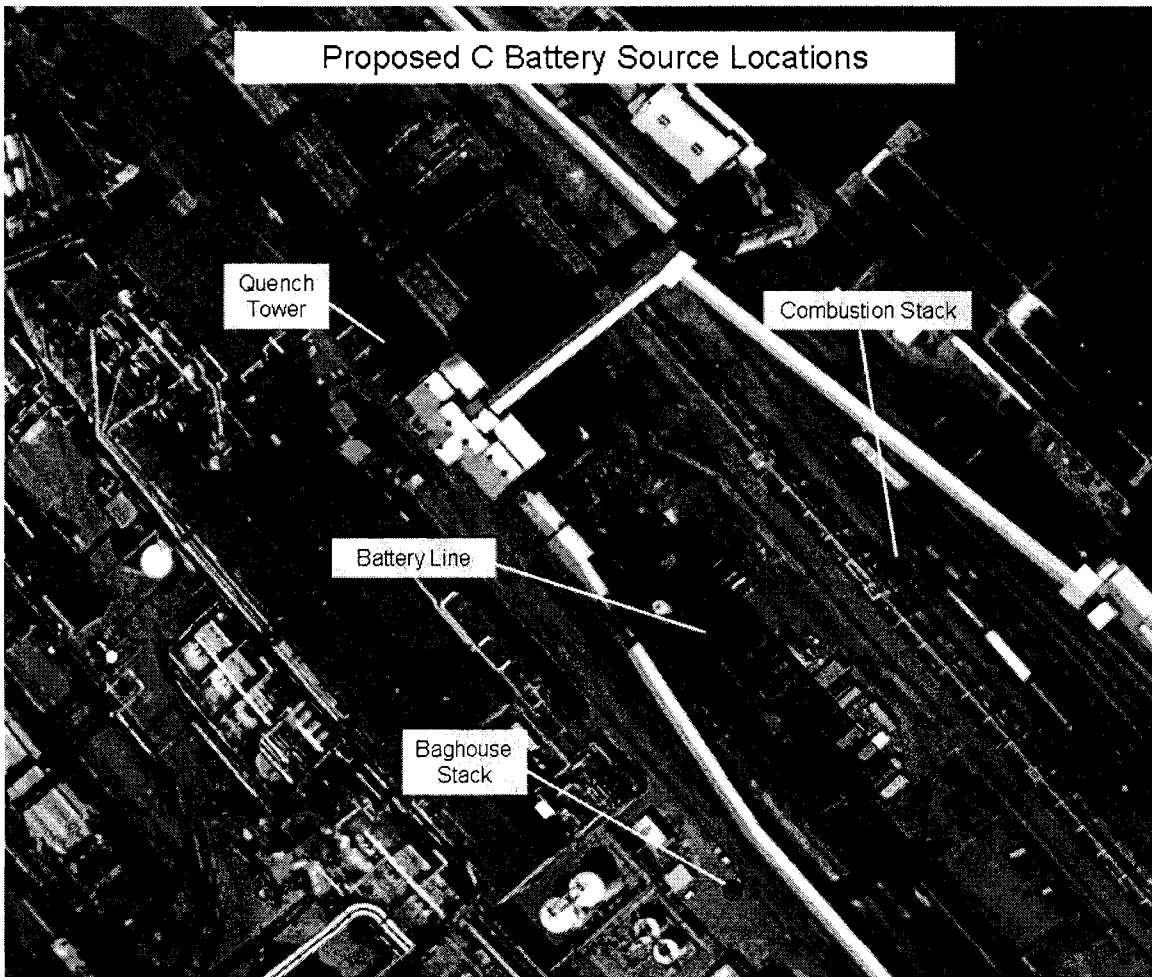
Source Parameters

C Battery is to be located to the southeast of B Battery, with similar dimensions to those of B Battery. Batteries 7-9 lie further to the southeast and would be simultaneously shutdown with the construction of C Battery.

The tables below provide the physical parameters of the sources included in the Batteries C & 7-9 modeling. Battery line fugitives include PEC, traveling, soaking, and other fugitives; battery buoyancies are calculated from flow rates and temperature gradients for each battery line. Horizontal dimensions for volume and area sources have been excluded from these tables.

Point Source	X (km)	Y (km)	Height (m)	Elevation (m)	Diameter (m)	Exit Vel. (m/s)	Exit Temp. (deg K)
C Battery Combustion Stack	595.697	4462.198	98.14	231.6	3.660	5.810	503.20
Quench Tower C	595.563	4462.237	49.98	231.0	12.670	3.660	378.00
C Battery PEC Baghouse	595.650	4462.101	30.00	230.7	2.490	15.100	328.20
Battery 7 Combustion Stack	595.887	4461.864	68.58	230.7	2.591	7.580	563.00
Battery 8 Combustion Stack	595.880	4461.874	68.58	230.7	2.591	7.660	561.90
Battery 9 Combustion Stack	595.761	4462.014	68.58	230.6	2.591	6.715	560.80
Quench Tower 3 (Batt. 7-9)	595.991	4461.777	30.50	231.0	3.200	3.600	350.00
Batteries 7-9 PEC Baghouse	595.856	4461.879	24.99	230.6	1.220	7.142	394.10

Line Source	Begin. X (km)	Begin. Y (km)	End. X (km)	End. Y (km)	Elevation (m)	Bldg. Length/ Width/Height (m)	Exit Velocity (m/s))	Line Width (m)	Buoyancy (m4/s3)
C Battery Fugitives	595.612	4462.214	595.693	4462.126	231.0	118/13.7/15.1	6.1	0.231	6598
Batteries 7-9 Fugitives	595.780	4462.027	595.972	4461.811	231.0	291/13.7/8.5	6.1	0.234	6634

Volume Source	Effective Height (m)	Elevation (m)	Initial Sigma y (m)	Initial Sigma z (m)
Ball Mill C	15.67	230.7	3.640	5.11
Coke Loadout C	12.19	230.7	2.500	11.34
Coke Screen C	12.19	230.7	2.500	11.34
Pulverizer 1 Primary	18.29	230.4	5.670	17.01
Continuous Unloader 1	12.19	230.7	2.500	11.34
Clamshell Unloader	2.23	230.6	3.381	2.07
Coal Transfer	7.62	230.7	2.054	7.09
Ball Mill, Loadout, Screening (Batteries 7-9)	24.99	230.6	5.810	4.39

Area Source	Effective Height (m)	Elevation (m)	Initial Sigma z (m)
Coal Pile Erosion	15.24	231.6	0
Coke Pile Erosion	13.72	231.6	0
Coke Transfer	13.72	231.6	0

Meteorology and Geophysical Data

Meteorology was based on 2002 hourly data (8753 hours total). The year 2002 was selected due to the extensive review of the data as part of the ACHD $PM_{2.5}$ SIP modeling. 2002 meteorology was not favorable toward low air quality levels (e.g., exceptionally wet or cold weather), so it is adequate for worst-case scenarios from the C Battery modeling. Inputs included the following:

- Mesoscale Model Version 5 (MM5) gridded upper air meteorology for Southwestern PA, the Northern WV Panhandle, and Eastern OH at 12-km grid resolution
- Allegheny County Airport, ACHD Liberty, and U.S. Steel Clairton surface data
- Pittsburgh International Airport precipitation data

Terrain and land use inputs included the following:

- U.S. Geological Survey (USGS) 7.5' Digital Elevation Model (DEM) terrain data at 30-meter spacing
- USGS National Land Cover Data (NLCD) 1992 land use data at 30-meter spacing

The meteorological processor CALMET processed these inputs at 100-meter resolution for a domain of 20-km x 20-km, centered on the ACHD Liberty monitoring site. The Universal Transverse Mercator (UTM) NAD83 system was used for all coordinates.

Receptor Grids

The following receptor grid settings were used for the impact analysis, by pollutant:

- $PM_{2.5}$: 500-meter radius around Liberty and Clairton $PM_{2.5}$ monitor sites, at 100-meter spacing within an elevation difference of 40 feet, based on the "nearby" receptor analysis used in the ACHD $PM_{2.5}$ SIP modeling grids

- PM_{10}, SO_2, toxics, and other: Variable spacing at 100 to 500 meters, most dense at Lincoln, based on ACHD PM_{10} SIP modeling grid

For $PM_{2.5}$, impacts were analyzed separately for Liberty and Clairton nearby grids, based on the specific siting requirements for Federal Reference Method (FRM) $PM_{2.5}$ monitors. For the other pollutants, the impacts at any off-property receptor were analyzed for maximum impacts.

The modeling analysis focused on positive impacts from the new C Battery at these receptors, with corresponding negative impacts due to the shutdown of Batteries 7-9.

Introduction

On December 31, 2007, the Allegheny County Health Department (ACHD) Air Quality Program received an installation permit application for a new coke oven battery (C Battery) at the U.S. Steel Clairton Works. The permit application was revised on April 25, 2008, and final modeled results for the proposed installation were received on April 23, 2008. This installation would include the termination of the current Batteries 7-9 and corresponding processes.

A modeling protocol for the potential air quality impacts created by the proposed modification was submitted and approved in February 2008. Energy and Environmental Management, Inc. (E²M) performed the modeling on behalf of U.S. Steel. All modeling files used in this demonstration were submitted to ACHD for review on April 21, 2008.

Model Selection

Concurrent with use of the CALPUFF[1] modeling system for the ACHD PM$_{2.5}$ State Implementation Plan (SIP) for attainment of the annual standard, CALPUFF was selected as the model for use in the C Battery modeling. CALPUFF is an EPA-preferred model[2] that is most widely used for long-range visibility modeling, but its incorporation of buoyant plume rise algorithms, gridded upper air meteorology, and complex geophysical processing makes it advantageous for this short-range application.

Methodology

Modeling was performed on a source-by-source basis using the CALPUFF dispersion model. The associated post-processors CALSUM and CALPOST were then used to sum and scale individual runs and calculate total impacts. E²M developed additional post-processor programs for the modeling submittal in order to provide impacts in tabular format by individual source.

All emissions were modeled as positive impacts in CALPUFF. The CALSUM post-processor allowed for negative scaling of Batteries 7-9 impacts, showing net differential results from C Battery without Batteries 7-9.

ACHD has reviewed the submitted modeling using both the default CALPUFF post-processors and the supplied E²M post-processor programs to verify the inputs. Modeling performed without the E²M post-processors are shown in this document as verification to the submitted results.

---

[1] CALPUFF Modeling System web site: http://www.src.com/calpuff/calpuff1.htm

[2] EPA preferred/recommended models web site: http://www.epa.gov/scram001/dispersion_prefrec.htm
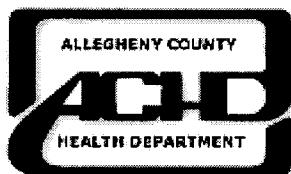
Modeling Review of U.S. Steel Clairton Works Proposed C Battery Installation with Shutdown of Batteries 7-9

TO:

Sandra Etzel, Chief, Engineering Section
Tom Heron, Engineering Section

FROM:

Jason Maranche, Planning and Data Analysis Section

DATE:

May 5, 2008

APPENDIX D

Modeling Review of U.S. Steel Clairton Works Proposed C Battery Installation with Shutdown of Batteries 7-9

is achieved. Once full production is achieved on C Battery, 7 and 8 batteries will be shut down over a 2-to-3 day period.

Once 7 & 8 batteries are shut down, the batteries will be demolished, in preparation for the installation of D battery foundations, followed by D battery construction on the 7-9 battery site.

Full Production Performance Test

After the normal capacity level at 18 hour coking time is reached on C battery, fine tuning of the heating system will continue to achieve optimum operating conditions with regard to heat consumption, uniform heating, and environmental performance. This may take a few more months after reaching the normal capacity level. Then the battery will be ready for a Performance Test.

Once the battery has run for at least four weeks at full production under stable operating conditions, the Full production Performance Test will commence. The Performance Test will be conducted for the required number of days in accordance with the established test protocol, as agreed between the parties.

ovens/day schedule on 7 and 8 batteries until C Battery is up to full schedule to avoid the loss of beneficial sealing carbon on 7 and 8 batteries.

Planned Steps in the
Commissioning of C Battery
From First Charge to Full Production

Introduction

The initial operation of the battery during the ramping up of production (from first charge to full production level) is as important to the integrity of the battery refractory as the proper heat-up. The battery is intentionally started at a lower than normal production level to minimize the thermal stresses on the refractory. A step-by-step program is prescribed as shown in the attached "Expected capacity increase after start-up" table. It will take about three months to safely and efficiently reach full production after the first charge on the new battery.

Activities During the Ramping Up of Production

The battery is heated up to 2,100°F and all work is done in preparation for the first charge. After the first oven is charged, the oven is connected to the collecting main, and the PROven System is ready to serve the battery operation. All the ovens are charged in accordance with the prescribed pushing schedule. Battery will be operated at 24 hour coking time during the first charge, so charging the entire battery will take 24 hours. Over the course of the following three months, the coking time will be gradually decreased to an 18 hour coking time, corresponding to "normal operation". This gradual process involves periods of stabilization after each step of coking time decrease. Each step of increase in capacity, or decrease in coking time, comes with a required increase of flue temperatures. Hence, the reason for the dwell time between steps of increase in capacity, is first to bring the entire mass of refractory to the higher level of temperature and, secondly, to make the finer adjustments to the heating system. It may even be necessary to utilize a test group of walls to determine the ideal settings of the heating system components, and incorporate the test results to the rest of the battery. These fine-tuning settings are required to adjust the heating system to the specific coal blends utilized at Clairton Works during battery commissioning.

The bracing system springs will be adjusted after every charging cycle during the early stages of the battery operation (after first charge). Similarly, the PROven System will be fine-tuned to match the operating conditions specific to the commissioning coal blends.

Charging and pushing schedules are changed at each step of commissioning to match the coking time requirements, until full production

First Stage of Heat-Up

After the installation of the battery refractory and steelwork is complete and all the preparatory work is done, the heat-up of the battery begins by lighting all of the heat-up burners. Temperatures are continuously monitored and adjustments to the heat input are made to ensure the actual temperatures follow the heat-up curve closely over time. The most significant part of the thermal expansion of the silica refractory takes place during the first half of the heat-up. The bracing system, including the longitudinal bracing and cross bracing springs, is set to the "heat-up stage to 1,100°F" position, and monitored closely. The system is adjusted as necessary according to the prescribed procedure. The expansion of the battery is recorded in three directions, length, width and height during the heat-up. The hot gas introduced into the oven chamber flows through special openings into the heating flues and out the through waste gas valves. This way the entire refractory structure, including the waste heat regenerators, is heated up to design temperatures.

Heating with Underfiring Gas (Normal Heating)

After about 50 days of heat-up, when the refractory temperature reaches and is stable at 1,490 °F, a switch over to using the battery underfiring system and reversing system for heat input takes place, and the external heat-up burners are turned off. The special openings on the heating walls are closed and sealed. Special nozzles will be used during the heat-up stage to feed the proper amount of gas to the heating walls. In addition to the thermocouple readings, temperature readings will be taken in the flues using infrared pyrometers.

During this stage of heating, the gas nozzles, air and waste gas valve settings are adjusted on every heating wall, not only to increase the temperature, but also to maintain temperature uniformity along the length of the battery.

The bracing system will be adjusted to the "over 1,100 °F" range when that temperature is reached, even before the start of "normal heating", and the corresponding spring adjustments will be made. Once the temperature is at 1,800 °F, the bracing system is set and adjusted to "operation" range. After about 90 days, the flues reach a temperature of 2,100 °F. The heat-up period is over and the battery is ready for charging. At this point in time during the heat-up of C battery, Clairton's No. 9 battery will be shut down, and 7 & 8 batteries will be reduced to about 120 ovens per day (50% of typical full schedule for 7-9), significantly reducing the total emissions from the 7-9 battery unit, and more than offsetting the emissions from C battery at the start-up production level. The 120 ovens/day schedule enables batteries 7 and 8 to be maintained hot enough to prevent the loss of beneficial sealing carbon and minimizes the development of internal thermal stresses which might otherwise increase oven-to-flue leakage and stack emissions on 7 and 8 batteries. It is preferred to hold this 120

Summary of the Heat-Up and Commissioning Activities for the New C Battery at U.S. Steel Clairton Works

(prepared by Udhe Corporation and U. S. Steel Corporation)

Heat-up Introduction

Heating-up is a critical activity in the construction and start-up of a new coke oven battery. It plays a major role in the life and integrity of the battery refractory. The secret to a successful heat-up is the slow and uniform increase in temperature of every part of the massive refractory structure.

There are two main stages of the heat-up operation. The first stage is when the heat is supplied by external burners until the refractory mass reaches a critical gas ignition temperature. This stage is followed by burning gas in the flues of the heating walls to reach the final operating temperature.

Preparation for Heating-Up

The new installed battery is ready for heat-up when the refractory installation is almost complete, except for a few courses of the oven roof section. The oven doors are installed on both the pusher side and the coke side of the ovens. Burners are set up along the pusher and coke side benches. Each oven will have a burner on the pusher side and another on the coke side. Coke oven gas will be used as the fuel for the burners and temporary piping will be installed to supply gas to the burners. For monitoring and controlling the temperature of the refractory, thermocouples will be set up at specific locations. A data collection system is installed to gather the temperature information used for controlling the rise of temperature in accordance with preset heat-up curves which project thermocouple aim temperatures versus time.

During heat-up, the refractory expands. The silica brick, which is located in the hotter areas of the battery refractory structure, expands more quickly than the fireclay, which is located in the cooler, lower areas. There is a provision for expansion joints in the refractory design and installation, which when combined with the battery bracing system, accommodates this differential expansion rate. The bracing systems control the expansion as necessary to achieve the final dimensions and gas tightness of the heated-up refractory structure.

The battery heating system, including all gas piping, reversing system, gas, air and waste gas valves, is installed, tested and ready to be put in service once the appropriate refractory temperatures are reached.

APPENDIX C

SUMMARY OF THE HEAT-UP AND COMMISSIONING ACTIVITIES
FOR THE NEW C BATTERY AT U. S. STEEL CLAIRTON WORKS

(prepared by Udhe Corporation and U. S. Steel Corporation)
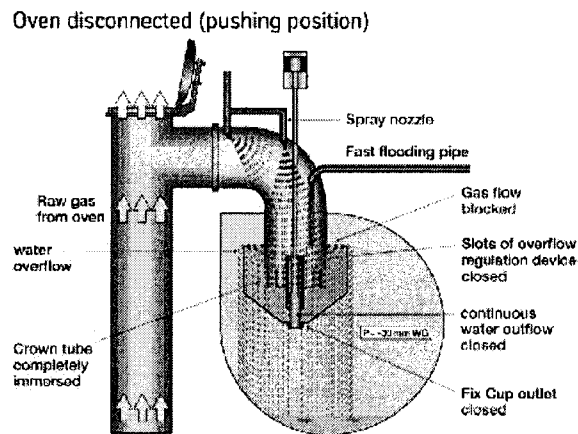
Oven disconnected (pushing position)

Figure 5: Oven disconnected from the gas collecting main

In summary, the PROven® system maintains the gas collecting main under negative pressure (suction) and each individual oven is maintained at a very low and relatively constant positive pressure. The advantages of the PROven® system are:

1. Eliminates the need for steam or air aspiration during charging which increases the volumetric flow into the collecting main and therefore increases collecting main pressure. This pressure increase also causes pressure peaks in ovens adjacent to the oven being charged.

2. Improved emission control from:

   a. Oven doors;
   b. Charging ports; and
   c. Ascension pipes

3. Elimination of air ingress into the oven.

4. Reduced oven pressure will lessen the incidence of leakage of raw coke oven gas from the ovens into the heating flues. This will result in a decrease in emissions from the combustion stack.

5. Improved control of oven pressure throughout the coking cycle will also reduce the amount of damage to refractory material. Extending the life of the refractory will also reduce the need for wall patching and other related maintenance activities.
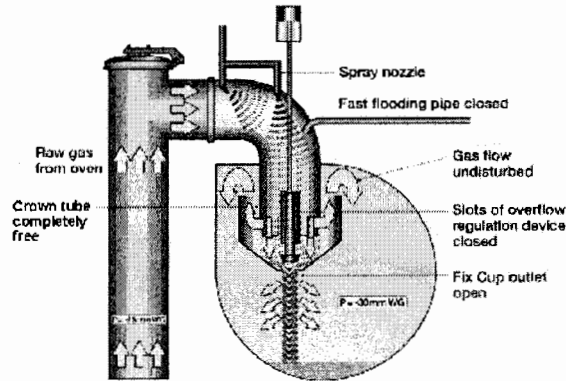
Figure 2: Oven connected for charging

After charging the overflow regulation device is lowered, closing the drain hole of the FixCup by the plug. The ammonia liquor sprayed into the standpipe elbow is collected in the FixCup and the water level slowly rises up to the overflow level adjusted by the overflow regulation device. In this control position, the slots of the crown tube are partly immersed into the water, reducing the free space through which the raw gas can be drawn into the gas collecting main. With rising water level the free space is reduced, while by lowering the water level the free space is increased. The pressure controller constantly compares the actual pressure in the standpipe elbow with the desired set point, regulating the water level in the FixCup via the control valve, pneumatic cylinder and overflow regulation device accordingly.
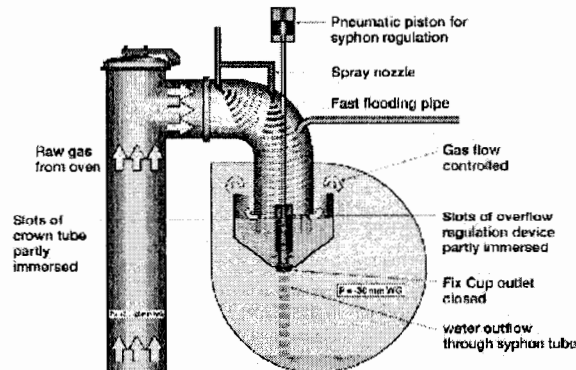
Figure 3: Control position of the PROVen® system

When the coal in an oven chamber is fully carbonized and there is no further raw gas produced, which is indicated by the position of the actuator for the overflow regulation device, the slots in the overflow regulation device are completely closed, effecting a further rise of the water level until the water is overflowing at the top level of the FixCup. By the rising water level, the slots in the crown tube are flooded completely, disconnecting the oven from the gas collecting main.

In order to shorten the time for the disconnection of the oven, the fast flooding pipe is opened to supply ammonia liquor for filling of the FixCup in addition to the flow of liquor sprayed into the standpipe elbow. At the same time, the standpipe lid is opened automatically by a pneumatic cylinder which will then close the lid after pushing, before the next coal charge.

DESIGN AND FUNCTION OF PROVEN®

The basic principle of the PROven® system is to operate the gas collecting main under suction of approximately –30 mm WG and to install pressure controllers for each single oven. In Figures 1 to 4, the schematic arrangement and function of these pressure controllers is illustrated in their different states of operation.

The PROven® arrangement mainly consists of:

- The crown tube, being a pipe with calibrated slots cut into its end, fitted to the downstream end of the standpipe elbow. The standpipe connects the oven to the collector main.
- The FixCup which is a conical shaped vessel with a drain hole at its bottom, being suspended inside of the gas collecting main. The water level in the FixCup is used for partly or completely closing the slots at the end of the crown tube.
- The overflow regulation device, consisting of the regulation part for the water level and the plug for the drain hole in the FixCup. This device is actuated by a pneumatic cylinder.
- The pressure controller, taking a pressure measurement in the standpipe elbow and, by a control valve, controlling the position of the pneumatic cylinder for the actuation of the overflow regulation device.
- The fast flooding pipe which supplies ammonia liquor to quickly fill the FixCup to allow the oven to be disconnected from the gas collecting main.
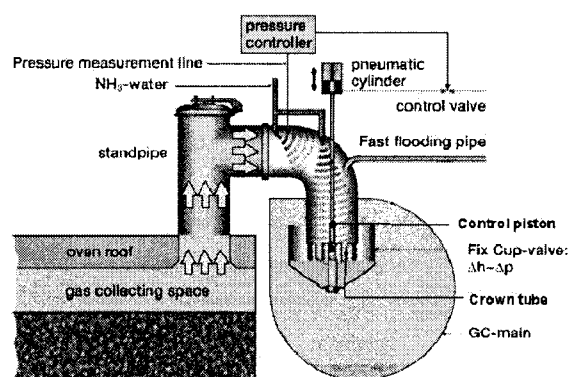
Figure 1: Schematic arrangement of PROven®

During charging of an oven, the overflow regulation device including the plug is lifted to its uppermost position. The FixCup is drained completely and the raw gas can flow undisturbed into the Gas collecting main. In this position the full suction of the gas collecting main is available in the standpipe elbow, providing for a perfect discharge of the large initial gas amounts during charging. Oven aspiration by high pressure water or steam injection is not required during coal charging.

APPENDIX B

DESIGN AND FUNCTION OF THE PRESSURE REGULATED OVEN (PROven®) SYSTEM

From the calculations presented in Appendix C2-1, it is observed that the emissions of CO are 14% smaller in Battery C than in Batteries 7-9.

Appendix C14-1
Travel and Pushing Emissions

Tables 12.2-6 and 12.2-7 in EPA's AP-42 estimate the pushing emission factors at an average capture efficiency of 74.1%. This efficiency also takes into account the travel emissions (pushing and travel have not been broken down as separate operations in AP-42). Since the travel emissions are essentially uncontrolled, the final value of average capture efficiency is low (74.1%).

U.S. Steel has attempted to break out its travel emissions from the pushing emissions. The physical and chemical changes occurring during both pushing and travel operations have been discussed in Appendix C7. The only emissions caused by travel are due to combustion of the incandescent coke due to exposure to air and volatile organic compounds emissions from green coke.

Travel emissions are calculated based on a rate of emissions (lb/ton coke/sec of travel time) and the time of travel. The average distance traveled by the ovens in Batteries 7-9 to the quench tower is 660 feel whereas the average distance traveled by the ovens in Battery B (and also C) to the quench tower is 375 feet which is almost half the distance traveled by 7-9. Based on the pushes per day for 7-9 and B (and C) it was estimated that the total travel time in sec/day for 7-9 was 14,380 sec whereas it was only 3,375 sec only for B. Appendix C5-1 discusses the derivation of these travel times.

The combustion emission factors were derived from AP-42 using combustion of bituminous coal in overfeed stoker boilers. These EFs are in units of lb/ton coal. The derivation of the emission factors in lb/ton coke/sec has been shown in Appendix C5-1.

Based on an average pushing time of 65 sec/push, the carbon and hydrogen combusted in terms of lb burned/ton coke/sec were computed based on tests of PEC bag house inlet and outlet streams at ABC Coke (Birmingham, Alabama, August 11 – 13, 1998) and at Bethlehem Steel (Chesterton, Indiana, aka Burns Harbor). These (lb burned/ton coke/sec) were multiplied by the lb/ton coal EFs of Ap-42 for bituminous coal combustion in an overfeed stoker boiler to get the EFs for travel emissions in lb/ton coke/sec. Due to the reduced travel time in the case of Battery B (and C), the travel emissions are seen to reduce appreciably.

Door 2

Roof

Height

Door 1

Length

Width
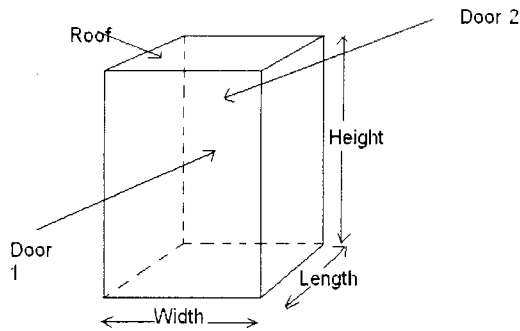
Only those surfaces are incorporated in the surface area calculations for which carbon burning is possible. Those surfaces are the walls (there are only two such walls; with the doors removed) and the roof of the oven. Since the floor of the oven is always covered with coal during the coking process, there is no un-coked coal adhering to the floor.
Therefore:

$$Surface\ area = (2 \times height + width) * length$$

The length between the doors in Batteries 7-9 is greater than the length between the doors in Battery C, which makes the exposed surface area of Battery C during decarbonization much greater than Batteries 7-9. During the coking cycle, it is estimated that a layer of carbon 0.03 inches, 0.01 inches and 0.03 inches thick forms at the tunnel head, the other wall areas and the charging holes, respectively. The volume of carbon removed from these areas was calculated as the product of surface areas and the thickness of the layer of carbon accumulated on the surfaces during the cycle. The mass of carbon removed ($C_{removed}$) from the surfaces per cycle was calculated as the product of the volume of carbon removed and the density of graphite.

The coal charged to each oven per cycle is divided by the number of pushes per battery per day to get the total coal charged ($C_{charged}$) per day. The carbon consumed ($C_{consumed}$) during decarbonization can be calculated by dividing the weight of carbon removed per cycle ($C_{removed}$) by the coal charged per oven per cycle. The carbon removed (in the units of lb/ton coal) can then be calculated as follows:

$$EF_{C\ removed} = \frac{C_{removed} * ((12 + 16)/12)}{Coal\ Chrgd\ per\ oven} \quad \text{(Lb/ton coal)}$$

Approximately 95% of the CO emissions undergo complete combustion (to form carbon dioxide, CO_2) at the SP exit. Therefore, the final emission factor for CO during the decarbonization process is:

$$EF_{CO} = \left(\frac{C_{removed} * ((12 + 16)/12)}{Coal\ Chrgd\ per\ oven} \right) * 0.05 \quad \text{(Lb/ton coal)}$$

Emissions from door, jamb, coke face and "fallout" prior to push (CS)
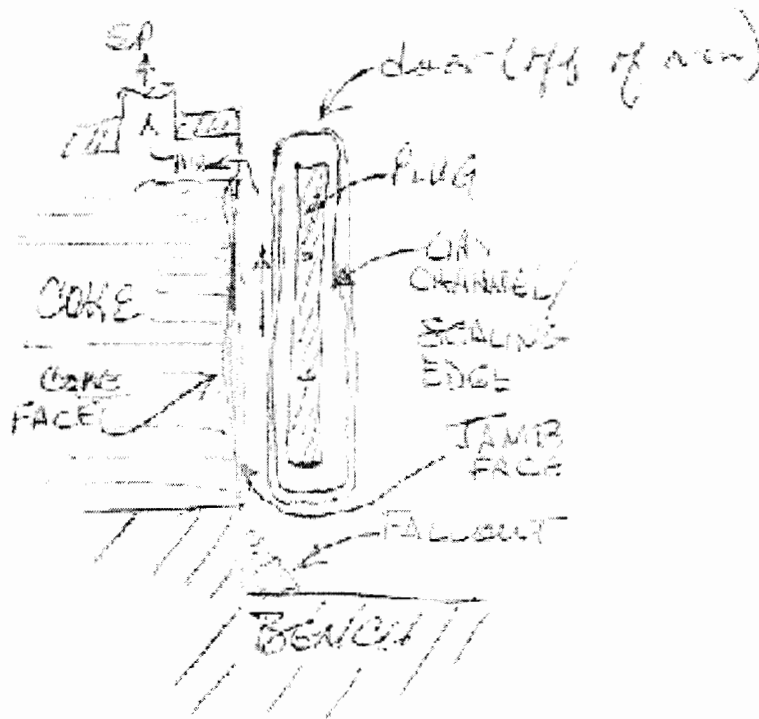
Appendix C13
Decarbonization Emissions

To estimate the decarbonization emissions, Battery C was assumed to be the same size as Battery B. During decarbonization, the oven doors are opened and the carbon (mostly in the form of soot) stuck to the internal surface of each oven is burnt off. In order to calculate the amount of carbon burned from the internal surface during decarbonization:

First the internal surface areas of the various components of a coke oven need to be calculated. The ovens are divided into three parts namely the tunnel head region that extends from the coal line to the roof of the oven, the wall areas that extend from the floor of the oven to the coal line and the charging holes that extend from the roof of the coke oven to the top of the battery.
A side view of the coke oven is shown in Figure 1. The dimension marked "Length" is the distance between the two doors.

VM from Jamb	7-9 Batteries		C Battery	
Area of Jamb Face	9.5 ft^2		14.1 ft^2	
Tar Volatilized from Jamb	0.00 in/cycle		0.00 in/cycle	
	Percent of Emissions		Percent of Emissions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
	80.0%	20.0%	80.0%	20.0%

V. Evaporation of Tar from the Gas Channel, Sealing Edge and Door Plug

Tar accumulates in the gas channel, on the door sealing edges and on the door plug and retainer during the coking cycle. Even though the majority of tar is cleaned each cycle, some remains on these surfaces. The door components are hot when the door is removed and have considerable mass to retain heat. However, they are not in contact with the heated portion of the battery and will cool more quickly than the jambs. Typically there is no combustion, but the temperature remains high causing some tar to evaporate.

Estimates of how much tar evaporates have been made based on coke plant experience and engineering judgment. An insignificant fraction of the emissions flow to the CS standpipe because the door is physically removed from the oven and rests at a distance of several feet from the oven; all emissions are emitted to atmosphere (7-9) or captured by the PEC (C Battery, at the capture efficiency). The estimates used in the current calculations are shown below.

VM from Door Plug & Gas Channel	7-9 Batteries		C Battery	
Area of Door Plug	27.7 ft^2		45.0 ft^2	
Tar Volatilized from Door Plug	0.0005 in/cycle		0.0005 in/cycle	
Area of Gas Channel & Sealing Strip	9.5 ft^2		14.1 ft^2	
Tar Volatilized from Sealing Strip & Gas Channel	0.0005 in/cycle		0.0005 in/cycle	
	Percent of Emissions		Percent of Emissions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
VM from Door Plug	0.0%	100.0%	0.0%	100.0%
VM from Gas Channel & Sealing Strip	0.0%	100.0%	0.0%	100.0%

judgment. The estimates used in the current calculations are shown below. Emissions generation rates are based on combustion of anthracite, AP42 Table 1.2-4.

Combustion at CS Face	7-9 Batteries		C Battery	
Area of Coke Face	18.1	ft²	30.6	ft²
Coke Burned at Coke Face (CS)	0.05	lb/min/ft²	0.05	lb/min/ft²
	Percent of Emissions		Percent of missions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
	90.0%	10.0%	90.0%	10.0%

III. Combustion of "Fallout"

Often when the CS door is removed, some coke falls from the oven onto the bench and remains there until returned to the oven or quenched. Also, after the push some, coke remains in the coke guide. Similar to the hot coke face, some of the fallout burns, generating emissions that are either drawn into the oven, emitted to atmosphere or, in the case of C Battery, captured by the PEC hood.

Estimates of how much of the fallout coke is burned and the fractions of the emission that flow to the CS standpipe versus being emitted to atmosphere have been made based on coke plant experience and engineering judgment. The estimates used in the current calculations are shown below. Emissions generation rates are based on combustion of anthracite, AP42 Table 1.2-4.

Combustion of "Fallout"	7-9 Batteries		C Battery	
Average "Fallout" per Oven	17.0	lb	17.0	lb
Fraction of "Fallout" Burned	0.02		0.02	
	Percent of Emissions		Percent of Emissions	
	Drawn to SP & Burned	Emitted Directly to Atm	Drawn to SP & Burned	Captured by Hood
	25.0%	75.0%	25.0%	75.0%

IV. Evaporation of Tar from the CS Jamb

Tar accumulates on the jamb face during the coking cycle. Even though the majority of tar is cleaned from the jamb each cycle, some remains on the jamb. The jamb is hot when the door is removed and is constantly in contact with the heated refractory. Typically there is no combustion, but the jamb temperature remains high causing some tar to evaporate from the jamb.

Estimates of how much tar evaporates and the fractions of the emission that flow to the CS standpipe versus being emitted to atmosphere have been made based on coke plant experience and engineering judgment. The estimates used in the current calculations are shown below.

Appendix C-12

Discussion of Emissions Rates from Battery "Pre-Push" with Proposed C Battery Technology as Compared to Batteries 7-9

January 21, 2008

I. Description of Process

From the time an oven door is removed from the battery's coke side (CS) in preparation for pushing until the door is replaced there is a possibility of emissions from the vicinity of the open door. These emissions sources can be put into categories corresponding to five areas of the operating unit:

- Combustion at the coke face,
- Combustion of "fallout" coke,
- Evaporation of tar from the CS jamb,
- Evaporation of tar from the sealing components of the door (sealing edge and gas channel) and
- Evaporation of tar from the door plug and retainer

Each of the areas is affected by a different set of conditions that result in different types and quantities of emissions.

At Batteries 7-9, there is no mechanism for capture of these emissions. C Battery however, will be equipped with a better PEC hood design that will capture those emissions.

Some parameters used in the calculation of these emissions are shown in the table below.

	7-9 Batteries		C Battery	
Coal Charge @ 50lb/ft^3 (6% H$_2$O)	15.7	Tons/oven	36.8	Tons/oven
Coke Produced @ 69% TC Yield	10.5	Tons/oven	24.7	Tons/oven
Length of Time from Door Off to Push	10	min	10	min
Length of Time from Push to Door On	2	min	2	min
Pushes per Day @ 18 hr CT	256	pushes	112	pushes
Capture Efficiency	0.0%		95.0%	
Baghouse Efficiency	0.0%		99.0%	

II. Combustion at the Coke Face

When the door is off the oven, the hot coke at the CS face is exposed to the atmosphere and burns. The hot coke (at Batteries 7-9, the open standpipe above the CS face) induces a draft along the coke face. Some of the emissions generated by the combustion are drawn into the oven and either burned or emitted from the top of the standpipe. At batteries 7-9 the emissions that are not drawn into the oven are emitted to atmosphere, on C battery they will be captured by the PEC hood.

Estimates of how much coke is burned at the CS face and the fraction of the emission flowing to the CS standpipe versus being emitted to atmosphere have been made based on coke plant experience and engineering

Appendix C7

Notes: Travel Emissions Clairton Batteries 7-9 vs. Battery C

December 18, 2007

1. EPA's AP-42 pushing emissions estimates use 74.1% capture efficiency. However, that efficiency includes uncontrolled travel which according to the NESHAP BID justifies using the low value. It is important for USS to treat pushing and travel separately because C Battery with a significantly shorter average travel distance (oven to Q tower) compared to 7-9 Batteries will realize a substantial reduction in travel emissions.

2. From an emissions perspective, pushing and travel are two entirely different components of the coking operation.

    During pushing the coke mass is moving, breaking apart, falling a significant distance, landing in the hot car while being exposed to high velocity air and combustion gasses as air is drawn into the PEC hood and coke burns. A large quantity of particulate matter is generated mechanically. The PEC hood design is properly intended to provide as tight a seal as practical to maximize capture efficiency. However, minimizing air infiltration leads to inefficient combustion of coke and residual VM and consequently PM generation.

    Travel, on the other hand, is a relatively tranquil operation. Only combustion, influenced by the draft induced by the burning coke and the motion of the hot car, affects emissions. Therefore, travel should be treated strictly as a combustion source.

3. Travel emissions can be estimated using two parameters: an emissions rate (expressed in lb/ton of coke/second of travel) and travel time from the oven to the quench tower.

4. Little, if any, testing of travel emissions has been published. However, EPA conducted tests of PEC baghouse inlet and outlet streams at ABC Coke (Birmingham, Alabama, August 11 – 13, 1998) and at Bethlehem Steel (Chesterton, Indiana, aka Burns Harbor). Those tests included extensive testing of the inlet and outlet streams of the baghouse including their water and carbon dioxide content. From those test results it is possible to calculate the hydrogen and carbon consumed by combustion during the push and to express the H & C combustion in terms of pound consumed per ton of coke per second. That result provides a conservative estimate of the combustion that occurs during travel.

5. Emission rates for coal combustion are applied to the combustion during travel to estimate travel emissions.

6. Using this method, a reduction in emissions of approximately 40% is demonstrated.

7. Comparing to the USS factor estimated to be 10% of pushing emissions:

Estimating Method	Travel Emissions (tons/yr)			
	NO_x	CO	PM_{10}	SO_2
10% of Pushing, 7-9 Batts	1.1	NA	16.5	42.8
Equivalent Coal combustion, 7-9 Batts	12.5	10.0	10.0	46.7
Equivalent Coal combustion, C Batt	7.4	5.9	5.9	27.7

SUMMARY -- Effect of C Battery PEC Hood, Capture of Emissions from CS During Prep for Push, NOX, SOX, CO & VOC

Revised 1/30/2008

7-9 Batteries

		CS NOX, SOX, CO & VOC Generated Before Push Begins	Destroyed in SP or Exit via SP	Rest of NOX, SOX, CO & VOC	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks
		(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(lb/ton coal)	(lb/ton coal)
Coke Face	NOX	1.59	1.430	0.159	0.159	0.000	2.23E-04	0.00E+00
Fallout	NOX	0.06	0.015	0.045	0.045	0.000	6.27E-05	0
TOTAL	NOX						2.86E-04	0.00E+00
Coke Face	SOX	5.64	5.072	0.564	0.564	0.000	7.91E-04	0.00E+00
Fallout	SOX	0.21	0.053	0.158	0.158	0.000	2.22E-04	0
TOTAL	SOX						1.01E-03	0.00E+00
Coke Face	CO	1.27	1.144	0.127	0.127	0.000	1.78E-04	0.00E+00
Fallout	CO	0.048	0.012	0.036	0.036	0.000	5.02E-05	0
TOTAL	CO						2.29E-04	0.00E+00
Jamb	VOC	0.11	0.088	0.022	0.022	0.000	3.10E-05	0
Gas Channel	VOC	0.03	0.000	0.028	0.028	0.000	3.88E-05	0
Door Plug	VOC	0.08	0.000	0.081	0.081	0.000	1.13E-04	0
TOTAL	VOC						1.83E-04	0.00E+00

C Battery

		CS NOX, SOX, CO & VOC Generated Before Push Begins	Destroyed in SP or Exit via SP	Rest of NOX, SOX, CO & VOC	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks	Released at CS (Not Captured by Hood)	Released at Baghouse Stacks
		(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(ton/yr)	(lb/ton coal)	(lb/ton coal)
Coke Face	NOX	1.17	1.056	0.117	0.006	0.111	8.00E-06	1.52E-04
Fallout	NOX	0.03	0.007	0.020	0.001	0.019	1.33E-06	2.5342E-05
TOTAL	NOX				0.007	0.130	9.34E-06	1.77E-04
Coke Face	SOX	4.16	3.744	0.416	0.021	0.395	2.84E-05	5.39E-04
Fallout	SOX	0.09	0.023	0.069	0.003	0.066	4.73E-06	8.9881E-05
TOTAL	SOX				0.024	0.461	3.31E-05	6.29E-04
Coke Face	CO	0.94	0.844	0.094	0.005	0.089	6.40E-06	1.22E-04
Fallout	CO	0.021	0.005	0.016	0.001	0.015	1.07E-06	2.0274E-05
TOTAL	CO				0.005	0.104	7.47E-06	1.42E-04
Jamb	VOC	0.07	0.058	0.014	0.001	0.014	9.82E-07	1.8662E-05
Gas Channel	VOC	0.02	0.000	0.018	0.001	0.017	1.23E-06	2.3327E-05
Door Plug	VOC	0.06	0.000	0.057	0.003	0.055	3.92E-06	7.4536E-05
TOTAL	VOC				0.004	0.072	6.13E-06	1.17E-04

Appendix C 5-1 Travel Emission Factors

	ABC Test		BSC Test		Average		
~Sec/ Push[1]	65		65		65		Coke S
	lb burned / ton coke	lb burned / ton coke / sec	lb burned / ton coke	lb burned / ton coke / sec	lb burned / ton coke	lb burned / ton coke / sec	0.70%
Hydrogen	0.90	0.0139	0.67	0.0103	0.79	0.0121	
Carbon	6.83	0.1051	5.26	0.0810	6.05	0.0930	

	NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO_2
Emission Factors[2]				lb / ton coal [5]				
	7.5	6	16	6	2.2	0.04	16.04	28.0
				lb/ sec/ ton coke				
Referenced Cells	3.94E-04	3.15E-04	8.41E-04	3.15E-04	1.16E-04	2.10E-06	8.43E-04	0.001472

7-9 Batteries								
NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO2
lb/ day								
59.5	47.6	127.0	47.6	17.5	0.32	127.3	222.2
ton/ yr								
10.9	8.7	23.2	8.7	3.2	0.06	23.2	40.6

C Battery ≈ B Battery								
NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO2
lb/ day								
35.3	28.3	75.4	28.3	10.4	0.19	75.6	131.9
ton/ yr								
6.4	5.2	13.8	5.2	1.9	0.03	13.8	24.1

Reduction								
NOX	CO	PM (Filterable)	PM_{10} (Filterable)	$PM_{2.5}$ (Filterable)	PM (Cond'ble)	PM (Total)	SO2
ton/ yr								
4.4	3.5	9.4	3.5	1.3	0.02	9.4	16.5
40.6%	40.6%	40.6%	40.6%	40.6%	40.6%	40.6%	40.6%

[1] Elapsed time from coke face begins to move until hot car leaves hood
[2] Estimated from AP42, Combustion of bituminous coal in overfeed stoker boilers.
[3] N/A
[4] See size distribution
[5] AP42, Overfeed stoker-fired boiler

Detailed Summary:

Emissions Location	Pollutant	7-9 Batteries						
		CS PM & BSO Generated Before Push Begins (ton/yr)	Destroyed in SP or Exit via SP (ton/yr)	Rest of PM & BSO (ton/yr)	Released at CS (Not Captured by Hood) (ton/yr)	Released at Baghouse Stacks (ton/yr)	Total Emissions (Excl via SP) (ton/yr)	Total Emissions (Excl via SP) (lb/ton coal)
Coke Face	PM10	4.87	4.39	0.49	0.49	0.00	0.49	6.8E-04
	PM2.5	1.27	1.14	0.13	0.13	0.00	0.13	1.8E-04
Fallout	PM10	0.18	0.05	0.14	0.14	0.00	0.14	1.9E-04
	PM2.5	0.05	0.01	0.04	0.04	0.00	0.04	5.0E-05
Jamb	BSO	5.5	4.4	1.1	1.1	0.0	1.1	1.6E-03
Gas Channel	BSO	1.4	0.0	1.4	1.4	0.0	1.4	1.9E-03
Door Plug	BSO	4.0	0.0	4.0	4.0	0.0	4.0	5.7E-03

Emissions Location	Pollutant	C Battery						
		CS PM & BSO Generated Before Push Begins (ton/yr)	Destroyed in SP or Exit via SP (ton/yr)	Rest of PM & BSO (ton/yr)	Released at CS (Not Captured by Hood) (ton/yr)	Released at Baghouse Stacks (ton/yr)	Total Emissions (Excl via SP) (ton/yr)	Total Emissions (Excl via SP) (lb/ton coal)
Coke Face	PM10	3.60	3.24	0.36	0.02	0.00	0.02	2.9E-05
	PM2.5	0.94	0.84	0.09	0.00	0.00	0.01	7.6E-06
Fallout	PM10	0.08	0.02	0.06	0.00	0.00	0.00	4.9E-06
	PM2.5	0.02	0.01	0.02	0.00	0.00	0.00	1.3E-06
Jamb	BSO	3.6	2.9	0.7	0.0	0.0	0.0	5.8E-05
Gas Channel	BSO	0.9	0.0	0.9	0.0	0.0	0.1	7.3E-05
Door Plug	BSO	2.9	0.0	2.9	0.1	0.0	0.2	2.3E-04

Table C4 - 1

SUMMARY -- Effect of C Battery PEC Hood, Capture of Emissions from CS During Prep for Push

Emissions Location	Pollutant	7-9 Batteries		C Battery		Reductions Resulting from C Battery		
		Total Emissions (Excl via SP) [Note 1] (ton/yr)	Total Emissions (Excl via SP) [Note 1] (lb/ton coal)	Total Emissions (Excl via SP) [Note 1] (ton/yr)	Total Emissions (Excl via SP) [Note 1] (lb/ton coal)	Total Emissions (Excl via SP) [Note 1] (ton/yr)	Total Emissions (Excl via SP) [Note 1] (lb/ton coal)	Total Emissions (Excl via SP) [Note 1] (%)
Coke Face	PM10	0.487	6.8E-04	0.021	2.9E-05	0.47	0.0007	95.6%
	PM2.5	0.127	1.8E-04	0.006	7.6E-06	0.12	0.0002	95.6%
Fallout [Note 2]	PM10	0.137	1.9E-04	0.004	4.9E-06	0.13	0.0002	97.4%
	PM2.5	0.036	5.0E-05	0.001	1.3E-06	0.03	0.0000	97.4%
Jamb	BSO	1.11	1.6E-03	0.04	5.8E-05	1.06	0.0015	96.1%
Gas Channel	BSO	1.38	1.9E-03	0.05	7.3E-05	1.33	0.0019	96.1%
Door Plug	BSO	4.04	5.7E-03	0.17	2.3E-04	3.87	0.0054	95.8%
TOTAL [Note 3]	$PM_{2.5}$	6.69	0.00939	0.27	0.00037	6.42	0.009	95.9%
TOTAL [Note 3]	PM_{10}	7.16	0.01004	0.29	0.00040	6.86	0.010	95.9%

Notes

1   When the oven door is off and the SP open, draft from the open SP draws a portion of the emissions generated on the CS into the oven and through the open SP. Some of those emissions will be burned as they pass through the tunnel head & SP. It is assumed that there is no change in the quantity or nature of those emissions in C Battery. This table addresses only the emissions not drawn into the SP.

2   Often, when the CS door is removed a small amount of coke falls from the coke face onto the bench. Generally this coke burns until it is returned to the oven or removed.

3   Assumes BSO is 100% PM2.5

NOTE 12/19/2007: C BATTERY WILL BE A SINGLE COLLECTOR MAIN BATTERY WITH THE MAIN LOCATED ON THE PS OF THE OVENS. THE CALCULATIONS SUMMARIZED ABOVE ASSUME A STANDPIPE LOCATED ON THE CS OF THE BATTERY INDUCING A DRAFT & DRAWING SOME OF THE EMISSIONS FROM THE COKE FACE & CS JAMB INTO THE SP. THOSE EMISSIONS MAY BE BURNED IN THE SP OR EMITTED TO ATMOSPHERE UNCHANGED. HAVING NO SP OR JUMPER PIPE ON THE CS IS LIKELY TO REDUCE THE DRAFT EFFECT AND RESULT IN MORE EFFICIENT CAPTURE OF EMISSIONS FROM THE COKE FACE & CS JAMB. THAT ADDITIONAL CAPTURE IS NOT REFLECTED IN THE ABOVE ESTIMATE. THEREFORE THE C BATTERY EMISSION RATE IS SOMEWHAT CONSERVATIVE (HIGH).

Offtake Leaks

	Batteries 7-9				Battery C				Battery C w/ PROven	
PLO	$E_{OFFTAKES}$	$E_{OFFTAKES}$	N_{OFFTKS}	N_{OVENS}	$E_{OFFTAKES}$	$E_{OFFTAKES}$	N_{OFFTKS}	N_{OVENS}	$E_{OFFTAKES}$	$E_{OFFTAKES}$
(%)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)
0.0	0.000	0.000	384	192	0.000	0.000	84	84	0.000	0.000
1.0	0.028	0.013	384	192	0.006	0.003	84	84	0.006	0.002
1.5	0.042	0.019	384	192	0.009	0.004	84	84	0.008	0.004
2.0	0.056	0.025	384	192	0.012	0.006	84	84	0.011	0.005
NESHAP Limit 2.5	0.070	0.032	384	192	0.015	0.007	84	84	0.014	0.006
ACTUAL PLO 0.7	0.020	0.009	384	192						

NOTE: REVISED FOR ONE OFFTAKE PER OVEN ON C BATTERY, NO JUMPER PIPE

A	E_{OFFTKS} =	BSO Emission Rate, Offtakes
P	PLO =	Average Percent Leaking lids as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
4	N_{OFFTKS} =	Total number of lids on the battery
2	0.0033	= Typical lid leak rate, kg/hr
USS	10.0%	= Percent reduction attributable to PROven

NESHAP Limits (PLO)	
Batteries 7-9	2.5
Battery C, (6M, brownfield battery)	2.5

Batteries 7-9 Actual PLO, base period	0.71	Rev 01-31-08

Charging Emissions

	Batteries 7-9				Battery C				Battery C w/ PROven	
VE	E_{CHG}	E_{CHG}	T	N_{OVENS}	E_{CHG}	E_{CHG}	T	N_{OVENS}	E_{CHG}	E_{CHG}
(sec)	(lb/hr)	(kg/hr)	(hr)	(number)	(lb/hr)	(kg/hr)	(hr)	(number)	(lb/hr)	(kg/hr)
0.0	0.000	0.000	18	192	0.000	0.000	18	84	0.000	0.000
3.0	0.030	0.013	18	192	0.013	0.006	18	84	0.013	0.006
6.0	0.059	0.027	18	192	0.026	0.012	18	84	0.026	0.012
9.0	0.089	0.040	18	192	0.039	0.018	18	84	0.039	0.018
NESHAP Limit 12.0	0.119	0.054	18	192	0.052	0.024	18	84	0.052	0.024
ACTUAL Sec/chg 5.0	0.049	0.022	18	192						

A	E_{CHG} =	BSO Emission Rate, Charging
P	Chg Sec =	Average Percent Leaking lids as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
4	T =	Coking cycle time, hr
2	VE =	Average seconds of visible emissions per charge
	0.0042	= Typical emission rate per charge, kg/charge *
USS	0.0%	= Percent reduction attributable to PROven

* According to AP42 nomenclature these units are kg/charge. Proper units are kg/sec of VE.

NESHAP Limits (Sec/chg)	
Batteries 7-9	12
Battery C, (6M, brownfield battery)	12

Batteries 7-9 Actual Sec/chg, base period	4.95	Rev 01-31-08

Table C3 - 1
Estimated BSO Emissions Rates -- Doors, Lids, Offtakes & Charging
Based on AP-42 Draft, July, 2007

Revised 1/18/08
Revised 1/31/08

Door Leaks

Enter Values for Shaded Cells

	PLD	Batteries 7-9					Battery C w/o PROven					Battery C w/ PROven	
		E_{DOORS}	E_{DOORS}	N_{DOORS}	N_{OVENS}	F_b	E_{DOORS}	E_{DOORS}	N_{DOORS}	N_{OVENS}	F_b	E_{DOORS}	E_{DOORS}
	(%)	(lb/hr)	(kg/hr)	(number)	(number)	(fract)	(lb/hr)	(kg/hr)	(number)	(number)	(fract)	(lb/hr)	(kg/hr)
	0	0.559	0.253	384	192	0.06	0.244	0.111	168	84	0.06	0.122	0.055
	1	0.720	0.326	384	192	0.06	0.315	0.143	168	84	0.06	0.157	0.071
	2	0.881	0.399	384	192	0.06	0.385	0.175	168	84	0.06	0.193	0.087
	3	1.041	0.472	384	192	0.06	0.456	0.207	168	84	0.06	0.228	0.103
NESHAP Limit 1- 3	3.8	1.170	0.531	384	192	0.06	0.512	0.232	168	84	0.06	0.256	0.116
	4						0.526	0.239	168	84	0.06	0.263	0.119
NESHAP Limit C	4.3						0.547	0.248	168	84	0.06	0.274	0.124
ACTUAL PLD	0.9	0.704	0.319	384	192	0.06							

A P 4 2	E_{DOORS} =	BSO Emission Rate, Doors
	PLD =	Average Percent Leaking Doors as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
	N_{DOORS} =	Total number of doors on the battery
	F_b =	Fraction of the doors with visible leaks from the bench but not from the yard
	0.06	F_b default = 0.06 in the absence of battery-specific bench observations
	0.011	= Typical door leak rate for doors that from the bench have visible leaks, kg/hr
	0.000	= Door leak rate for doors without visible leaks, kg/hr
USS	50.0%	= Percent reduction attributable to PROven

NESHAP Limits (PLD)	
Batteries 7-9	3.8
Battery C, (6M, brownfield battery)	4.3

Batteries 7-9 Actual PLD, base period	0.90	Rev 01-31-08

Lid Leaks

Enter Values for Shaded Cells

	PLL	Batteries 7-9				Battery C				Battery C w/ PROven	
		E_{LIDS}	E_{LIDS}	N_{LIDS}	N_{OVENS}	E_{LIDS}	E_{LIDS}	N_{LIDS}	N_{OVENS}	E_{LIDS}	E_{LIDS}
	(%)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)	(number)	(number)	(lb/hr)	(kg/hr)
	0	0.000	0.000	768	192	0.000	0.000	336	84	0.000	0.000
	0.1	0.006	0.003	768	192	0.002	0.001	336	84	0.002	0.001
	0.2	0.011	0.005	768	192	0.005	0.002	336	84	0.004	0.002
	0.3	0.017	0.008	768	192	0.007	0.003	336	84	0.007	0.003
NESHAP Limit	0.4	0.022	0.010	768	192	0.010	0.004	336	84	0.009	0.004
ACTUAL PLL	0.03	0.002	0.001	768	192						

A P 4 2	E_{LIDS} =	BSO Emission Rate, Lids
	PLL =	Average Percent Leaking lids as determined by Method 303
	N_{OVENS} =	Total number of ovens on the battery
	N_{LIDS} =	Total number of lids on the battery
	0.0033	= Typical lid leak rate, kg/hr
USS	10.0%	= Percent reduction attributable to PROven

NESHAP Limits (PLL)	
Batteries 7-9	0.4
Battery C, (6M, brownfield battery)	0.4

Batteries 7-9 Actual PLL, base period	0.03	Rev 01-31-08

Table C2 - 1 Decarbonization Emissions

Estimate Heat Release During Decarb
June 25, 2007 updated for C Battery 12/11/2006
(C Battery Oven Dimensions Assumed the Same as B Battery)

	Input: Oven Dimensions & Capacities
Input Options Key:	Input: Carbon Removal Estimates
	Input: Technical Data & Estimates

Estimate amount of C burned from internal surfaces during Decarbonization:			Clairton Batteries 7-9	Clairton Battery C
Tunnel Head Areas	Height, coal line to roof	(ft)	1.07	1.17
	Length between doors	(ft)	37.38	52.96
	Average width	(ft)	1.56	1.50
	SURFACE AREA	**(ft²)**	138.4	203.0
Other Wall Areas	Height to coal line	(ft)	10.78	18.83
	Length between doors	(ft)	37.38	52.96
	Average width	(ft)	1.56	1.50
	SURFACE AREA	**(ft²)**	864.1	2074.2
Charging Holes	Height, roof to battery top	(ft)	4.65	5.52
	Average length (est)	(ft)	2.75	2.75
	Width	(ft)	1.17	1.17
	SURFACE AREA	**(ft²)**	36.4	43.2

C Removed, Tunnel Head (average thickness / cycle)		(in)	0.03	0.03
	=	(ft)	0.0025	0.0025
C Removed, Other Wall Areas (average thickness / cycle)		(in)	0.01	0.01
	=	(ft)	0.0008	0.0008
C Removed, Charging Holes (average thickness / cycle)		(in)	0.03	0.03
	=	(ft)	0.0025	0.0025

C Removed (average volume / cycle)		(ft³)	1.2	2.3
C Density (Graphite, Perry 7th Ed)		(lb / ft³)	135	135
C Removed (average weight / cycle)		(lb)	156	316
Coal Charge / oven		(tons)	15.7	36.8
Ovens pushed / battery / day		(Ovens / battery / day)	86	110
Coal Charge (t/day)			4040	4048
C Consumed		(lb / ton coal)	10.0	8.6
CO Produced		(lb / ton coal)	23.3	20.1

Check: AP-42 CO Emissions from decarb = 29 lb of CO emitted / ton coal

		Above Calculation:	(lb/cycle)	(Lb C / ton coal)	(Equiv lb CO / ton coal)
	C Removed	7-9 Batts	156	9.98	23.3
		C Battery	316	8.60	20.1
	CO Emissions, 95% burnned at SP exit	7-9 Batts			1.16
		C Battery			1.00

RATIO CO Emissions from C Battery to 7-9 Batteries	0.862

CO Emissions Reduction from Decarbonizing =	14%

		lb/ton coal	TPY	TPY		TPY		lb/hr	lb/hr
	1,1-Biphenyl	0.0000	8.61E-03	9.24E-03		6.31E-04		1.97E-03	2.11E-03
	Ammonia	0.0260	1.60E+01	5.38E-01		-1.54E+01		3.65E+00	1.23E-01
	Anthracene	0.0001	4.61E-02	4.95E-02		3.38E-03		1.05E-02	1.13E-02
	Antimony	0.0005	2.91E-01	9.78E-03		-2.81E-01		6.64E-02	2.23E-03
	Benzo(a) Anthracene	0.0000	6.02E-03	6.47E-03		4.42E-04	VOC emissions are reduced by ~4.3% due to fewer quenches in C as compared to 7-9.	1.38E-03	1.48E-03
	Chromium Compounds	0.0047	2.90E+00	9.76E-02		-2.80E+00	The organic HAPs are also expected to undergo a similar decrease. Metals and ammonia are expected to be particulate in nature and are estimated to undergo the same reduction (97%) in C quench tower (due to the better baffle design) as against 7-9.	6.62E-01	2.23E-02
Quenching	Chrysene	0.0000	2.64E-02	2.84E-02		1.94E-03		6.04E-03	6.48E-03
	Cobalt	0.0002	1.48E-01	4.99E-03		-1.43E-01		3.38E-02	1.14E-03
	Coke Oven Emissions	0.0003	2.12E-01	2.28E-01		1.56E-02		4.84E-02	5.20E-02
	Cresols	0.0006	3.69E-01	3.96E-01		2.71E-02		8.42E-02	9.04E-02
	Cyanide Compounds	0.0020	1.23E+00	1.32E+00		9.02E-02		2.81E-01	3.01E-01
	Dibenzofuran	0.0000	2.77E-02	2.97E-02		2.03E-03		6.32E-03	6.78E-03
	Fluoranthene	0.0000	2.64E-02	2.84E-02		1.94E-03		6.04E-03	6.48E-03
	Mercury	0.0000	1.48E-03	4.96E-05		-1.43E-03		3.37E-04	1.13E-05
	Naphthalene	0.0003	2.03E-01	2.18E-01		1.49E-02		4.63E-02	4.97E-02
	Nickel	0.0006	3.65E-01	1.23E-02		-3.52E-01		8.32E-02	2.80E-02
	Phenanthrene	0.0001	4.61E-02	4.95E-02		3.38E-03		1.05E-02	1.13E-02
	Phenol	0.0026	1.60E+00	1.72E+00		1.17E-01		3.65E-01	3.92E-01
	7-PAH	0.0000	0.00E+00	0.00E+00		0.00E+00		0.00E+00	0.00E+00
	POM	0.0000	1.41E-02	1.52E-02		1.04E-03		3.23E-03	3.47E-03
	Pyrene	0.0000	2.21E-02	2.38E-02		1.62E-03		5.05E-03	5.42E-03
	Quinoline	0.0000	2.58E-02	2.77E-02		1.89E-03		5.90E-03	6.33E-03

Pollutant	Net Change	PSD Applicability
1,1-Biphenyl	0.0006	NO
Ammonia	-15.5076	NO
Anthracene	0.0034	NO
Antimony	-0.2810	NO
Benzo(a) Anthracene	0.0004	NO
Benzene	-0.2503	NO
Chromium Compounds	-2.8041	NO
Chlorine	-0.0216	NO
Hydrochloric acid	-0.9087	NO
Chrysene	0.0019	NO
Cobalt	-0.1432	NO
Coke Oven Emissions	0.0274	NO
Cresols	0.0271	NO
Cyanide Compounds	0.1094	NO
Dibenzofuran	0.0020	NO
Ethylbenzene	0.0000	NO
Ethylene	-0.0209	NO
Fluoranthene	0.0019	NO
Mercury	-0.0014	NO
Naphthalene	-0.1718	NO
Nickel	-0.3523	NO
Phenanthrene	0.0043	NO
Phenol	0.1173	NO
7-PAH	0.0006	NO
POM	-0.0044	NO
Pyrene	0.0016	NO
Quinoline	0.0019	NO
Styrene	0.0000	NO
Toluene	-0.0186	NO
Xylene	-0.0023	NO
TOTAL	-20.1885	NO

		lb/ton or lb/mmcf	TPY	TPY				lb/hr	lb/hr
Stacks	Ammonia (lb/mmcf)	0.0140	4.68E-02	4.29E-02	-3.97E-03			1.07E-02	9.79E-03
	Benzene (lb/ton)	0.0004	2.19E-01	1.84E-01	-3.47E-02			4.99E-02	4.20E-02
	Chlorine (lb/mmcf)	0.0761	2.55E-01	2.33E-01	-2.16E-02	25% reduction in		5.81E-02	5.32E-02
	Ethylbenzene (b/ton)	0.0000	0.00E+00	0.00E+00	0.00E+00	emissions of		0.00E+00	0.00E+00
	Hydrochloric Acid (lb/mmcf)	3.2067	1.07E+01	9.82E+00	-9.09E-01	organic compounds		2.45E+00	2.24E+00
	Naphthalene (lb/ton)	0.0010	5.96E-01	5.02E-01	-9.47E-02	due to better		1.36E-01	1.15E-01
	7-PAH (lb/mmcf)	0.0000	4.68E-05	3.21E-05	-1.47E-05	combustion		1.07E-05	7.34E-06
	POM (lb/ton)	0.0001	4.00E-02	3.36E-02	-6.35E-03	practices.		9.12E-03	7.67E-03
	Toluene (lb/ton)	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
	Xylene (lb/ton)	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY				lb/hr	lb/hr
PEC BH	Ammonia	0.0002	1.23E-01	1.38E-01	1.50E-02			2.81E-02	3.15E-02
	Anthracene	0.0000	2.77E-04	3.10E-04	3.36E-05			6.32E-05	7.08E-05
	Benzene	0.0003	1.71E-01	1.91E-01	2.08E-02			3.90E-02	4.37E-02
	Cyanide Compounds	0.0006	3.46E-01	3.88E-01	4.21E-02	PEC BH cannot		7.91E-02	8.87E-02
	Coke Oven Emissions	0.0002	1.16E-01	1.30E-01	1.41E-02	capture organic		2.64E-02	2.96E-02
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00	compounds; so no		0.00E+00	0.00E+00
	Naphthalene	0.0000	1.23E-02	1.38E-02	1.50E-03	change in efficiency		2.81E-03	3.15E-03
	Phenanthrene	0.0000	8.61E-03	9.65E-03	1.05E-03	between baseline		1.97E-03	2.20E-03
	7-PAH	0.0000	6.15E-03	6.90E-03	7.48E-04	and future predicted		1.40E-03	1.57E-03
	POM	0.0000	8.61E-03	9.65E-03	1.05E-03	emissions.		1.97E-03	2.20E-03
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY				lb/hr	lb/hr
Traveling	Ammonia	0.0000	1.23E-02	8.19E-03	-4.10E-03			2.81E-03	1.87E-03
	Anthracene	0.0000	2.77E-05	1.84E-05	-9.23E-06			6.32E-06	4.21E-06
	Benzene	0.0000	1.71E-02	1.14E-02	-5.70E-03			3.90E-03	2.60E-03
	Cyanide Compounds	0.0001	3.46E-02	2.31E-02	-1.16E-02			7.91E-03	5.27E-03
	Coke Oven Emissions	0.0000	1.16E-02	7.71E-03	-3.86E-03	40.6% reduction in		2.64E-03	1.76E-03
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00	travel emissions		0.00E+00	0.00E+00
	Naphthalene	0.0000	1.23E-03	8.19E-04	-4.10E-04	due to shorter travel		2.81E-04	1.87E-04
	Phenanthrene	0.0000	8.61E-04	5.73E-04	-2.87E-04	times.		1.97E-04	1.31E-04
	7-PAH	0.0000	6.15E-04	4.10E-04	-2.05E-04			1.40E-04	9.35E-05
	POM	0.0000	8.61E-04	5.73E-04	-2.87E-04			1.97E-04	1.31E-04
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY				lb/hr	lb/hr
PEC Fugitives	Ammonia	0.0000	1.68E-02	1.88E-02	2.04E-03			3.83E-03	4.29E-03
	Anthracene	0.0000	3.77E-05	4.23E-05	4.59E-06			8.61E-06	9.66E-06
	Benzene	0.0000	2.33E-02	2.61E-02	2.83E-03			5.31E-03	5.96E-03
	Cyanide Compounds	0.0001	4.72E-02	5.30E-02	5.74E-03	Organic		1.08E-02	1.21E-02
	Coke Oven Emissions	0.0000	1.58E-02	1.77E-02	1.92E-03	compounds are not		3.60E-03	4.04E-03
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00	captured by the		0.00E+00	0.00E+00
	Naphthalene	0.0000	1.68E-03	1.88E-03	2.04E-04	hood and hence the		3.83E-04	4.29E-04
	Phenanthrene	0.0000	1.17E-03	1.32E-03	1.43E-04	better capture		2.68E-04	3.01E-04
	7-PAH	0.0000	8.38E-04	9.40E-04	1.02E-04	efficiency of hood		1.91E-04	2.15E-04
	POM	0.0000	1.17E-03	1.32E-03	1.43E-04	on Battery C will not		2.68E-04	3.01E-04
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00	cause an emission		0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00	reduction.		0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00

		lb/ton coal	TPY	TPY				lb/hr	lb/hr
Uncontrolled Pushing	Ammonia	0.0002	7.60E-04	4.70E-04	-2.90E-04			1.74E-04	1.07E-04
	Anthracene	0.0000	1.71E-06	1.06E-06	-6.52E-07			3.90E-07	2.42E-07
	Benzene	0.0003	1.06E-03	6.53E-04	-4.03E-04			2.41E-04	1.49E-04
	Cyanide Compounds	0.0006	2.14E-03	1.32E-03	-8.17E-04	The percentage		4.89E-04	3.02E-04
	Coke Oven Emissions	0.0002	7.15E-04	4.42E-04	-2.73E-04	uncontrolled pushes		1.63E-04	1.01E-04
	Ethylbenzene	0.0000	0.00E+00	0.00E+00	0.00E+00	in 7-9 are 0.544%		0.00E+00	0.00E+00
	Naphthalene	0.0000	7.60E-05	4.70E-05	-2.90E-05	whereas in C they		1.74E-05	1.07E-05
	Phenanthrene	0.0000	5.32E-05	3.29E-05	-2.03E-05	reduce to 0.5%		1.21E-05	7.51E-06
	7-PAH	0.0000	3.80E-05	2.35E-05	-1.45E-05	leading to a		8.68E-06	5.37E-06
	POM	0.0000	5.32E-05	3.29E-05	-2.03E-05	decrease in HAP		1.21E-05	7.51E-06
	Styrene	0.0000	0.00E+00	0.00E+00	0.00E+00	emissions.		0.00E+00	0.00E+00
	Toluene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00
	Xylene	0.0000	0.00E+00	0.00E+00	0.00E+00			0.00E+00	0.00E+00

Table C1 - 16 (ii) HAP Emissions

	Batteries 7-9	Battery C	Units
TOTAL COAL CHARGED (per year @ 3.5% moisture)	1229551.0000	1,379,059.00	Tons
COKE OVEN GAS CHARGED	6690.0000	6,123.24	MMcf/year
BSO charging EF	0.0030	0.0030	lb/(secVE/chg)/hr

			Batteries 7-9	Battery C	NET (C minus 7-9)	NOTES	Batteries 7-9	Battery C
		sec VE/chg	TPY	TPY	TPY		lb/hr	lb/hr
Charging	Benzene	1.8702	2.45E-02	2.46E-02	5.73E-05		5.60E-03	5.61E-03
Charging	Cyanide Compounds	0.1309	1.72E-03	1.72E-03	4.01E-06		3.92E-04	3.93E-04
Charging	Naphthalene	0.7481	9.81E-03	9.83E-03	2.29E-05		2.24E-03	2.24E-03
Charging	7-PAH	0.0561	7.36E-04	7.37E-04	1.72E-06	0% reduction due to PROven	1.68E-04	1.68E-04
Charging	POM	2.9923	3.92E-02	3.93E-02	9.17E-05		8.96E-03	8.98E-03
Charging	Styrene	0.0281	3.68E-04	3.69E-04	8.60E-07		8.40E-05	8.42E-05
Charging	Toluene	0.1496	1.96E-03	1.97E-03	4.59E-06		4.48E-04	4.49E-04
Charging	Xylene	0.0748	9.81E-04	9.83E-04	2.29E-06		2.24E-04	2.24E-04
		lb/hr-leak * Ratio to BSO * 8760/2000	TPY	TPY			lb/hr	lb/hr
Doors	Ammonia	0.1380	1.38E-01	6.90E-02	-6.90E-02		3.15E-02	1.58E-02
Doors	Benzene	0.4599	4.60E-01	2.30E-01	-2.30E-01		1.05E-01	5.25E-02
Doors	Cyanide Compounds	0.0322	3.22E-02	1.61E-02	-1.61E-02	50% reduction due to the integrated hood and PROven. Lb/hr-leak = 0.022; Ratio to BSO from AP-42.	7.35E-03	3.68E-03
Doors	Ethylene	0.0368	3.68E-02	1.84E-02	-1.84E-02		8.40E-03	4.20E-03
Doors	Naphthalene	0.1840	1.84E-01	9.20E-02	-9.20E-02		4.20E-02	2.10E-02
Doors	7-PAH	0.0000	7.50E-06	3.75E-06	-3.75E-06		1.71E-06	8.56E-07
Doors	POM	0.7358	7.36E-01	3.68E-01	-3.68E-01		1.68E-01	8.40E-02
Doors	Propylene	0.0736	7.36E-02	3.68E-02	-3.68E-02		1.68E-02	8.40E-03
Doors	Toluene	0.0368	3.68E-02	1.84E-02	-1.84E-02		8.40E-03	4.20E-03
Doors	Xylene	0.0046	4.60E-03	2.30E-03	-2.30E-03		1.05E-03	5.25E-04
		lb/hr-leak * Ratio to BSO * 8760/2000	TPY	TPY			lb/hr	lb/hr
Lids	Ammonia	0.0048	4.77E-03	4.29E-03	-4.77E-04		1.09E-03	9.80E-04
Lids	Benzene	0.0159	1.59E-02	1.43E-02	-1.59E-03		3.63E-03	3.27E-03
Lids	Cyanide Compounds	0.0011	1.11E-03	1.00E-03	-1.11E-04		2.54E-04	2.29E-04
Lids	Ethylene	0.0127	1.27E-02	1.14E-02	-1.27E-03		2.90E-03	2.61E-03
Lids	Hydrogen Cyanide	0.0011	1.11E-03	1.00E-03	-1.11E-04	10% reduction due to PROven. Lb/hr-leak = 0.0073; Ratio to BSO from AP-42.	2.54E-04	2.29E-04
Lids	Naphthalene	0.0064	6.36E-03	5.72E-03	-6.36E-04		1.45E-03	1.31E-03
Lids	7-PAH	0.0000	7.50E-06	6.75E-06	-7.50E-07		1.71E-06	1.54E-06
Lids	POM	0.0254	2.54E-02	2.29E-02	-2.54E-03		5.81E-03	5.23E-03
Lids	Propylene	0.0025	2.54E-03	2.29E-03	-2.54E-04		5.81E-04	5.23E-04
Lids	Toluene	0.0013	1.27E-03	1.14E-03	-1.27E-04		2.90E-04	2.61E-04
Lids	Xylene	0.0002	1.59E-04	1.43E-04	-1.59E-05		3.63E-05	3.27E-05
		lb/hr-leak * Ratio to BSO * 8760/2000	TPY	TPY			lb/hr	lb/hr
Offtakes	Ammonia	0.0048	4.77E-03	4.29E-03	-4.77E-04		1.09E-03	9.80E-04
Offtakes	Benzene	0.0159	1.59E-02	1.43E-02	-1.59E-03		3.63E-03	3.27E-03
Offtakes	Cyanide Compounds	0.0011	1.11E-03	1.00E-03	-1.11E-04		2.54E-04	2.29E-04
Offtakes	Ethylene	0.0127	1.27E-02	1.14E-02	-1.27E-03		2.90E-03	2.61E-03
Offtakes	Hydrogen Cyanide	0.0011	1.11E-03	1.00E-03	-1.11E-04	10% reduction due to PROven. Lb/hr-leak = 0.0073; Ratio to BSO from AP-42.	2.54E-04	2.29E-04
Offtakes	Naphthalene	0.0064	6.36E-03	5.72E-03	-6.36E-04		1.45E-03	1.31E-03
Offtakes	7-PAH	0.0000	7.50E-06	6.75E-06	-7.50E-07		1.71E-06	1.54E-06
Offtakes	POM	0.0254	2.54E-02	2.29E-02	-2.54E-03		5.81E-03	5.23E-03
Offtakes	Propylene	0.0025	2.54E-03	2.29E-03	-2.54E-04		5.81E-04	5.23E-04
Offtakes	Toluene	0.0013	1.27E-03	1.14E-03	-1.27E-04		2.90E-04	2.61E-04
Offtakes	Xylene	0.0002	1.59E-04	1.43E-04	-1.59E-05		3.63E-05	3.27E-05

Table C1 - 16 (i) HAP Emissions

	7-9 Battery		C battery	
BSO charging EF	0.0029	lb/(secVE/chg)/hr	0.0035	lb/(secVE/chg)/hr

	TPY Values							
	Lead		Hydrogen Sulfide		Carbon Disulfide		Total Reduced Sulfur	
7-9 Batteries	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	9.355E-03			4.200E-05	2.568E-02		2.57E-02
Traveling	1.530E-06	9.355E-04			4.220E-06	2.580E-03		2.58E-03
PEC fugitives	2.509E-06	1.534E-03			5.750E-06	3.516E-03		3.52E-03
Uncontrolled pushing	5.480E-05	1.833E-04			4.800E-05	1.605E-04		1.61E-04
Quenching					5.490E-03	3.357E+00		3.36E+00
7-9 STACK TOTAL					3.150E-03	5.27E-03		5.27E-03
Ball Mill								
Soaking			4.300E-01	2.629E+02				2.63E+02
Decarbonization								
Fugitives			EF	TPY	EF	TPY		TPY
Doors			0.138	0.138	0.001	0.001		1.72E+01
Lids			4.800E-03	4.800E-03	3.200E-05	3.200E-05		4.83E-03
Offtakes			4.770E-03	4.770E-03	3.200E-05	3.200E-05		4.80E-03
			sec/chg	tons/year	sec/chg	tons/year		tons/year
Charging			5.600E-01	1.423E+01	1.180E-01	2.998E+00		1.72E+01
TOTAL		**1.201E-02**		**2.773E+02**		**6.393E+00**		**3.008E+02**
C Battery	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	1.052E-02			4.200E-05	2.887E-02		2.89E-02
Traveling	9.088E-07	6.248E-04			2.507E-06	1.723E-03		1.72E-03
PEC fugitives	1.530E-06	1.052E-03			5.750E-06	3.953E-03		3.95E-03
Uncontrolled pushing	5.480E-05	1.134E-04			4.570E-05	9.453E-05		9.45E-05
Quenching					5.254E-03	3.612E+00		3.61E+00
C STACK					2.363E-03	7.23E-03		7.23E-03
Ball Mill								
Soaking			2.150E-01	1.482E+02				1.48E+02
Decarbonization								
Fugitives			EF	TPY	EF	TPY		TPY
Doors			0.069	0.035	0.000	0.000		3.47E-02
Lids			4.320E-03	3.888E-03	2.880E-05	2.592E-05		3.91E-03
Offtakes			4.293E-03	3.864E-03	2.880E-05	2.592E-05		3.89E-03
			sec/chg	tons/year	sec/chg	tons/year		tons/year
Charging			5.600E-01	1.717E+01	1.180E-01	2.998E+00		2.02E+01
TOTAL		**0.012**		**148.291**		**3.654**		**151.945**
NET CHANGE (C minus 7-9)		**3.002E-04**		**-1.290E+02**		**-2.739E+00**		**-1.488E+02**

Table C1 - 15 Coke Handling Emissions

MATERIAL HANDLING (for the baseline period May 2002-April 2004 and future for C battery)

COKE HANDLING	Coke Pile (Load & unload)	Coke Transfer	Screen Stn.	Screening Stn. Loadout	Coke Pile Erosion	TOTAL
					Acre*day	TPY
Batteries 7-9 (tons per period)	2,062	896,421	896,421	896,421	8,785	
Emission Factors (lb/ton coke)						
PM$_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM$_{10}$	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
PM$_{2.5}$	0.01	3.18	0.12	0.09	2.28	5.7
PM$_{10}$	0.01	3.18	0.38	0.31	2.28	6.2
TSP	0.02	6.72	0.79	0.45	5.10	13.1
Battery C (tons)	2,547	1,107,384	1,107,384	1,107,384	10,852	
Emission Factors (lb/ton coke)						
PM$_{2.5}$	7.10E-03	7.10E-03	2.65E-04	2.00E-04	5.20E-01	
PM$_{10}$	7.10E-03	7.10E-03	8.40E-04	7.00E-04	5.20E-01	
TSP	1.50E-02	1.50E-02	1.76E-03	1.00E-03	1.16E+00	
Emissions (tons)						
PM$_{2.5}$	0.01	3.93	0.15	0.11	2.82	7.0
PM$_{10}$	0.01	3.93	0.47	0.39	2.82	7.6
TSP	0.02	8.31	0.98	0.55	6.29	16.1

Note: Emission factors for storage piles are in lb/(acre*day)

	Batteries 7-9 (TPY)	Battery C (TPY)	Reduction (TPY)
PM$_{2.5}$	5.68	7.02	
PM$_{10}$	6.16	7.61	
TSP	13.07	16.15	

	7-9 Batteries		C battery	
% uncontrolled coal	0.544%		0.50%	
Coal Charged (TOTAL)	1,229,551	Tons per year	1,379,059	Tons per year
Coal Charged (CONTROLLED)	1,222,862	Tons per year	1,374,922	Tons per year
Coal Charged (UNCONTROLLED)	6,689	Tons per year	4,137.18	Tons per year
COKE OVEN GAS CHARGED per period	13,380	MMcf per period	NA	MMcf per period
COKE OVEN GAS CHARGED per year	6,690.00	MMcf per year	6123.24	MMcf/year
COKE PRODUCED	896,421	Tons per year	1,107,384	Tons per year
Note: All coal charged values are at 3.5% coal moisture content.				

Table C1-14 Coal Handling Emissions

COAL HANDLING	Pulverizer				Unloader			Pedestal Crane	Coal Transfer	Boom Conveyor	Bins and Bunkers	Storage Piles	Emission TPY
	#1 Pri	#1 Sec	#2 Pri	#2 Sec	#1	#2	Clamshell					acre*day	
MATERIAL HANDLING (for 7-9 Batteries during the baseline period May 2002-April 2004 and potentials for C battery)													
Batteries 7-9 (tons per period)	1,229,551	-	-	-	1,168,073	-	184,433	61,478	1,229,551	110,660	1,229,551	12,296	
Emission Factors (lb/ton coal)													
PM$_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM$_{10}$	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
PM$_{2.5}$	0.09	-	-	-	0.07	-	0.01	0.00	0.10	0.01	0.00	12.79	13.1
PM$_{10}$	0.35	-	-	-	0.21	-	0.03	0.01	0.32	0.02	0.00	12.79	13.7
TSP	1.77	-	-	-	0.45	-	0.07	0.02	0.68	0.04	0.00	28.40	31.4
Battery C (tons per year)	1,379,059	-			1,310,106		275,812	137,906	1,379,059	165,487	1,379,059	13,791	
Emission Factors (lb/ton coal)													
PM$_{2.5}$	1.44E-04	2.52E-04	2.04E-05	3.40E-05	1.17E-04	1.16E-04	1.16E-04	1.16E-04	1.65E-04	1.17E-04	4.00E-06	2.08E+00	
PM$_{10}$	5.77E-04	1.01E-03	8.17E-05	1.36E-04	3.64E-04	3.60E-04	3.60E-04	3.60E-04	5.20E-04	3.64E-04	4.00E-06	2.08E+00	
TSP	2.88E-03	5.04E-03	4.08E-04	6.80E-04	7.77E-04	7.76E-04	7.76E-04	7.76E-04	1.10E-03	7.77E-04	6.24E-06	4.62E+00	
Emissions (tons)													
PM$_{2.5}$	0.10	-	-	-	0.08	-	0.02	0.01	0.11	0.01	0.00	14.34	14.7
PM$_{10}$	0.40	-	-	-	0.24	-	0.05	0.02	0.36	0.03	0.00	14.34	15.4
TSP	1.99	-	-	-	0.51	-	0.11	0.05	0.76	0.06	0.00	31.86	35.3

Note: Emission factors for storage piles are in lb/(acre*day)

	Batteries 7-9 (TPY)	Battery C (TPY)	Reduction (TPY)
PM$_{2.5}$	13.069	14.668	
PM$_{10}$	13.741	15.444	
TSP	31.448	35.341	

Table C1 - 13 Fugitive Emissions (charging, doors, lids, offtakes)

WITH HRM's RESULTS IN BOTH 7-9 AS WELL AS C BATTERY

HRM's CALCULATIONS DONE USING CURRENT ACTUAL EMISSIONS AND NESHAP LIMITS (FOR CHARGING, OFFTAKES, LIDS AND DOORS) FOR 7-9 BATTERIES AND C BATTERY RESPECTIVELY.

			CHARGING/DOORS/LIDS/OFFTAKES						
			7-9 Batteries			C Battery			
RATIO TO BSO	PROCESS	POLLUTANT	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	Reduction (TPY)
			lb/hr * Ratio to BSO	Tons per Year		lb/hr	Tons per Year		
NA	C	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA	H	SO$_2$							
1.8	A	PM total		0.386			0.409		
0.9	R	PM filter'bl	0.044	0.193		0.047	0.204		
0.9	G	PM condens'bl	0.044	0.193		0.047	0.204		
NA	I	PM$_{2.5}$ filter'bl							
NA	N	PM$_{10}$ filter'bl							
2.2	G	VOC	0.108	0.471		0.114	0.500		
1.1		CO	0.054	0.236		0.057	0.250		
NA		NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8	D	PM total	1.267	5.547		0.492	2.157		3.391
0.9	O	PM filter'bl	0.633	2.774		0.246	1.078		1.695
0.9	O	PM condens'bl	0.633	2.774		0.246	1.078		1.695
NA	R	PM$_{2.5}$ filter'bl							
NA	S	PM$_{10}$ filter'bl							
2.2		VOC	1.548	6.780		0.602	2.636		4.144
1.1		CO	0.774	3.390		0.301	1.318		2.072
NA		NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA		SO$_2$							
1.8	L	PM total	0.003	0.013		0.016	0.069		
0.9	I	PM filter'bl	0.002	0.007		0.008	0.035		
0.9	D	PM condens'bl	0.002	0.007		0.008	0.035		
NA	S	PM$_{2.5}$ filter'bl							
NA		PM$_{10}$ filter'bl							
2.2		VOC	0.004	0.016		0.019	0.085		
1.1		CO	0.002	0.008		0.010	0.042		
NA	O	NO$_x$			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "			From "AP 42 Doors Lids Offtakes Charging Formulas rev 013108.xls" ; Sheet "Doors Lids and Offtks "	
NA	F	SO$_2$							
1.8	F	PM total	0.036	0.156		0.025	0.108		0.048
0.9	T	PM filter'bl	0.018	0.078		0.012	0.054		0.024
0.9	A	PM condens'bl	0.018	0.078		0.012	0.054		0.024
NA	K	PM$_{2.5}$ filter'bl							
NA	E	PM$_{10}$ filter'bl							
2.2	S	VOC	0.044	0.191		0.030	0.133		0.059
1.1		CO	0.022	0.096		0.015	0.066		0.029

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 10 Ball Mill Emissions

	7-9 Battery		C battery	
DUST COMING OUT OF THE BH is approximately 0.063% of the coal charged	774.62	Tons	868.81	Tons

BALL MILL

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton BH dust	Tons per Year		lb/ton BH dust	Tons per Year		Tons per Year
PM filter'bl	4.00E-02	0.0155	1994 Title V Application, Appendix A	4.00E-02	0.017	1994 Title V Application, Appendix A	
PM$_{2.5}$ filter'bl	4.00E-02	0.0155	Assumed equal to PM-10 (filterable)	4.00E-02	0.017	Assumed equal to PM-10 (filterable)	
PM$_{10}$ filter'bl	4.00E-02	0.0155	1994 Title V Application, Appendix A	4.00E-02	0.017	1994 Title V Application, Appendix A	

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 11 Soaking Emissions

SOAKING

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO$_x$	1.00E-03	0.615	AP-42, 2007; Table 12.2-18	5.00E-04	0.345	Emission factors provided in AP-42, 2007; Table 12.2-18 were halved because soaking emissions are expected to be reduced by 50% by the PROven system	0.270
SO$_2$	9.90E-02	60.863		4.95E-02	34.132		26.731
VOC	6.00E-03	3.689		3.00E-03	2.069		1.620
PM total	1.50E-02	9.222		7.50E-03	5.171		4.050
PM filter'bl							
PM condens'bl							
PM$_{2.5}$ filter'bl							
PM$_{10}$ filter'bl							

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 12 Decarbonization Emissions

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
CO	1.16E+00	715.556	DECARB 121907.xls;	1.00E+00	691.780	DECARB 121907.xls;	

Table C1 - 9 Combustion (Underfire) Stack Emissions

	7-9 Battery		C battery			From April 2006-07 Stack Te	
COKE OVEN GAS CHARGED	13,380	MMcf per period	6123.24	MMcf/year			
MMscf/stack	4,460	MMcf per period	NA				
NUMBER OF PUSHES	174,192	Pushes	NA	Pushes			
COKE PRODUCED	1,792,841	Tons	1,107,384	Tons			
Heat value of COG	448	Btu/scf	448	Btu/scf		ACFM	DSCFM
Total BTUs/stack	1,998,080.00	MMBtu	2,743,211.52	Btu		75100	36000
Volumetric flow rate (stack 1)	43,600.00	dscfm	103,562.00	dcfm		74000	35200
Volumetric flow rate (stack 2)	32,200.00	dscfm	48,502.80	dscfm		102000	45900
Volumetric flow rate (stack 3)	42,700.00	dscfm				AVEARAGE	
Volumetric flow rate (TOTAL)	118,500.00	dscfm					

COMBUSTION STACKS

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor lb/MMBtu	Emissions Tons per Year	Reference for Emission Factor	Emission Factor lb/MMBtu	Emissions Tons per Year	Reference for Emission Factor	Tons per Year
STACK 7							
NO$_x$	8.07E-01	403.113	Emission factors derived from the stack tests conducted at Clairton works on Stack 7 on Feb 21 and 22, 2006. PM adjusted for opacity non-compliance. Results are averaged over 3 runs. The average volumetric flow rate during the test was 43,600 dscfm.			C Battery will have only one stack	
SO$_2$	6.90E-02	34.467					
VOC[1]	2.80E-02	3.497					
	gpdscf	Tons per Year					
PM total	2.60E-02	42.559					
PM filter'bl	2.10E-02	34.374					
PM condens'bl	5.00E-03	8.184					
PM$_{2.5}$ filter'bl	1.96E-02	32.140					
PM$_{10}$ filter'bl	2.01E-02	32.965					
STACK 8	lb/MMBtu	Tons per Year					
NO$_x$	5.15E-01	257.253	Emission factors derived from the stack tests conducted at Clairton works on Stack 8 on May 16 and 17, 2007. PM adjusted for opacity non-compliance. Results are averaged over 3 runs. The average volumetric flow rate during the test was 32,200 dscfm.			C Battery will have only one stack	
SO$_2$	6.70E-02	33.468					
VOC[1]	1.10E-02	1.374					
	gpdscf	Tons per Year					
PM total	2.28E-02	27.562					
PM filter'bl	1.82E-02	22.002					
PM condens'bl	4.60E-03	5.561					
PM$_{2.5}$ filter'bl	1.70E-02	20.572					
PM$_{10}$ filter'bl	1.75E-02	21.100					
STACK 9	lb/MMBtu	Tons per Year					
NO$_x$	7.50E-01	374.640	Emission factors derived from the stack tests conducted at Clairton works on Stack 9 on Feb. 23 and 24, 2006. PM adjusted for opacity non-compliance. Results are averaged over 3 runs. The average volumetric flow rate during the test was 42,700 dscfm.			C Battery will have only one stack	
SO$_2$	6.90E-02	34.467					
VOC[1]	1.50E-02	1.873					
	gpdscf	Tons per Year					
PM total	1.60E-02	25.649					
PM filter'bl	1.00E-02	16.031					
PM condens'bl	5.00E-03	8.015					
PM$_{2.5}$ filter'bl	9.35E-03	14.989					
PM$_{10}$ filter'bl	9.59E-03	15.374					
TOTAL STACK 7-9	lb/ton	Tons per Year		lb/year	Tons per Year		Tons per Year
NO$_x$		1035.005	These are the additions of the tonnage per year of each of the pollutants emitted from all	9.22E+05	461.182	Uhde (manufacturer) guarantee	573.823
				lb/MMBtu	Tons per Year		
SO$_2$		102.402		6.70E-02	91.898		10.504
VOC[1]		6.744		1.47E-02	5.029	C battery has only one stack. The Efs for the	1.714
		Tons per Year		gpdscf	Tons per Year		

Table C1 - 8 Quenching Emissions

	7-9 Battery		C battery	
COKE PRODUCED per year	896,421	Tons	1,107,384	Tons
Coke per quench	25	Tons	25	Tons

QUENCH TOWER

POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		Tons per Year
PM Filt	0.00E+00	280.40	Table 12.2-19. The TPM has been scaled up from PM2.5 by dividing the PM2.5 EF by 0.5.	2.00E-02	11.074	Manufacturer's (UHDE) guarantee	269.327
PM$_{2.5}$ Filt.		140.200		1.00E-02	5.537	Scaled down from total PM by multiplying the TPM EF by 0.5	134.664
PM$_{10}$ Filt.	0.00E+00	210.30	PM10 EF has been scaled down by multiplying the TPM EF by 0.75.	1.50E-02	8.305	Scaled down from total PM by multiplying the TPM EF by 0.75	201.995
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		
PM (condensible)	1.41E-01	86.683	non-PM constituents from the B test have the EF = 0.141lb/ton coal	1.41E-01	97.224	non-PM constituents from the B test have the EF = 0.141lb/ton coal	▉
PM Total		367.084			108.297		258.787
PM$_{2.5}$ (filt.+condensible)	5.06E-01	226.884	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007 adjusted for dirty baffles		102.761		124.123
PM$_{10}$ (filt.+condensible)		296.984			105.529		191.455
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		
VOC	7.92E-02	35.498	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	7.92E-02	43.852	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	▉
SO$_2$	2.31E-02	10.363	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	2.31E-02	12.801	Quench tower test conducted on B battery Quench tower on Oct. 3-5, 2007.	▉

Emission factors of lb/quench have been converted to lb/ton coke. FOR 7-9: PM10 = 0.75 * TSP and PM2.5 = 0.5 * TSP; FOR C: PM10 = 0.098 * TSP and PM2.5 = 0.06 * TSP

B Battery quench test results have been used for SO2 and VOC emissions factors for 7-9 as well as C.

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 7 PEC Fugitives (with hood)

	7-9 Battery	C battery
HOOD Capture efficiency	0.836	0.9

PUSHING FUGITIVES							
POLLUTANT	7-9 Batteries			C Battery			REDUCTION
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NOₓ	0.006	1.724	From "HRM PUSH Nox & SO2 122607.xls"	2.30E-03	0.938	From "HRM PUSH Nox & SO2 122607.xls"	0.787
SO₂	0.021	6.438	From "HRM PUSH Nox & SO2 122607.xls"	8.60E-03	3.501	From "HRM PUSH Nox & SO2 122607.xls"	2.936
PM total		171.965	TPM = PM filterable + PM condensible		119.128	AP-42, 2007 EF / 0.741 X 0.1	52.837
PM filter'bl	0.228	135.581	AP-42, 2007; Table 12.2-6	1.39E-01	94.181	AP-42, 2007 EF / 0.741 X 0.1	41.400
PM condens'bl	0.060	36.384	AP-42, 2007; Table 12.2-7	3.63E-02	24.947	AP-42, 2007 EF / 0.741 X 0.1	11.437
PM₂.₅ filter'bl	0.038	22.754	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	2.32E-02	15.769	AP-42, 2007 EF / 0.741 X 0.1	6.985
PM₁₀ filter'bl	0.099	58.927	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	6.02E-02	40.860	AP-42, 2007 EF / 0.741 X 0.1	18.067
CO	0.040	22.966	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063 (capture efficiency = 74.1%)	2.43E-02	16.206	AP-42, 2007 EF / 0.741 X 0.1	6.760
VOC	0.049	29.811	AP-42, 2007; Table 12.2-9; VOC uncontrolled =0.077 (capture efficiency = 74.1%)	2.97E-02	20.438	AP-42, 2007 EF / 0.741 X 0.1	9.373

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 6 Travel Emissions

| POLLUTANT | 7-9 Batteries | | | C Battery | | | REDUCTION |
| | Emission Factor | | Reference for Emission Factor | Emission Factor | Emissions | Reference for Emission Factor | |
	lb/ton coke/sec	Tons per Year		lb/ton coke/sec	Tons per Year		Tons per Year
NO$_x$	3.943E-04	10.863	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.943E-04	6.450	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	4.413
SO$_2$	1.472E-03	40.555	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.472E-03	24.080	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	16.475
PM total	8.432E-04	23.232	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	8.432E-04	13.794	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	9.438
PM filter'bl	8.411E-04	23.174	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	8.411E-04	13.760	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	9.414
PM condens'bl	2.103E-06	0.058	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	2.103E-06	0.034	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	0.024
PM$_{2.5}$ filter'bl	1.157E-04	3.186	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.157E-04	1.892	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	1.294
PM$_{10}$ filter'bl	3.154E-04	8.690	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.154E-04	5.160	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.530
CO	3.154E-04	8.690	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.154E-04	5.160	HRM TRAVEL 121907 rev 012308.xls; Travel Efs	3.530

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 5 Pushing Emission Control (PEC) Baghouse Emissions

	7-9 Batteries		C battery	
COKE OVEN GAS CHARGED	13,380	MMcf per period	6,123.24	MMcf/year
BH Exhaust flow rate	122,000	dscfm	175,200.00	dscfm
COKE PRODUCED	896,421	Tons	1,107,384	Tons
BH collection efficiency	0.98		0.99	

PEC BH

	7-9 Batteries			C Battery			REDUCTION
POLLUTANT	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO$_x$	2.21E-02	13.54	From "HRM PUSH Nox & SO2 122607.xls"	2.30E-02	15.933	From "HRM PUSH Nox & SO2 122607.xls"	
SO$_2$	8.27E-02	50.54	From "HRM PUSH Nox & SO2 122607.xls"	8.60E-02	59.463	From "HRM PUSH Nox & SO2 122607.xls"	
PM total		15.196	TPM = PM filterable + PM condensible		33.534	TPM = PM filterable + PM condensible	
	gr/dscf	Tons per Year		gr/dscf	Tons per year		
PM filter'bl	3.07E-03	14.046	Stack test July 24-26, 2007 conducted on Batteries 7-9 at Clairton Plant.	5.00E-03	32.888	Manufacturer's guarantee of outlet conc. = 0.005 gpdscf	
PM condens'bl	9.40E-02	1.15	AP-42, 2007; Table 12.2-7	9.40E-02	0.646	AP-42, 2007; Table 12.2-7	0.503
PM$_{2.5}$ filter'bl	5.12E-04	2.346	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	8.35E-04	5.492	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	
PM$_{10}$ filter'bl	1.33E-03	6.082	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	2.17E-03	14.240	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	
CO	5.54E-02	33.87	AP-42, 2007; Table 12.2-9	5.54E-02	38.169	AP-42, 2007; Table 12.2-9	
	lb/ton coke	Tons per Year		lb/ton coke	Tons per Year		
VOC	6.83E-03	3.06	Stack test Sep. 27-29, 2005 conducted on Batteries 7-9 at Clairton Plant.	2.10E-03	1.179	Stack test July 11-13 2006 conducted on Batteries 13-14 at Clairton Plant. The fraction of pre-push emissions emitted at the BH have also been added to the these values.	1.884

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 4 Pushing Fugitives (without Hood)

POLLUTANT	UNCONTROLLED PUSHING						REDUCTION
	7-9 Batteries			C Battery			
	Emission Factor	Emissions	Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO$_x$	7.34E-02	0.25	AP-42, 2007; Table 12.2-9; Nox uncontrolled =0.019/(1-74.1% capture efficiency)	0.073	0.152	AP-42, 2007; Table 12.2-9; Nox uncontrolled =0.019/74.1% capture efficiency	0.094
SO$_2$	0.3784	1.27	AP-42, 2007; Table 12.2-9; SO2 uncontrolled =0.098/(1-74.1% capture efficiency)	0.378	0.783	AP-42, 2007; Table 12.2-9; SO2 uncontrolled =0.098/74.1% capture efficiency	0.483
PM total		5.86	TPM = PM filterable + PM condensible	-	3.626	TPM = PM filterable + PM condensible	2.236
PM filter'bl	1.39E+00	4.65	AP-42, 2007; Table 12.2-6	1.390	2.875	AP-42, 2007; Table 12.2-6	1.773
PM condens'bl	3.63E-01	1.21	AP-42, 2007; Table 12.2-7	0.363	0.751	AP-42, 2007; Table 12.2-7	0.463
PM$_{2.5}$ filter'bl	2.32E-01	0.78	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	0.232	0.480	AP-42, 2007; Table 12.2-19; PM2.5 = 16.7% FPM	0.296
PM$_{10}$ filter'bl	6.02E-01	2.01	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	0.602	1.245	AP-42, 2007; Table 12.2-19; PM10 = 43.3% FPM	0.768
CO	2.43E-01	0.81	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/(1-capture efficiency) (74.1%)	0.243	0.503	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/capture efficiency (74.1%)	0.310
VOC	2.97E-01	0.99	AP-42, 2007; Table 12.2-9; VOC uncontrolled =0.077/(1-capture efficiency) (74.1%)	0.297	0.615	AP-42, 2007; Table 12.2-9; CO uncontrolled =0.063/capture efficiency (74.1%)	0.379

PM condensible = PM10 condensible = PM2.5 condensible

Table C1 - 3 Pre Push Emissions

POLLUTANT	PRE-PUSH						REDUCTION
	7-9 Batteries			C Battery			
	Emission Factor		Reference for Emission Factor	Emission Factor	Emissions	Reference for Emission Factor	
	lb/ton coal	Tons per Year		lb/ton coal	Tons per Year		Tons per Year
NO_x	2.86E-04	0.176	"HRM PRE_PUSH all pollut 013008.xls";	9.34E-06	0.006	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	0.169
SO_2	1.01E-03	0.623	"SUMRY NOX,SOX, CO,VOC" tab.	3.31E-05	0.023		0.600
PM total							
PM filter'bl		11.949	PM filterable = PM10 filterable+ PM2.5 filterable		12.869	PM filterable = PM10 filterable+ PM2.5 filterable	-0.920
PM condens'bl							
$PM_{2.5}$ filter'bl	9.39E-03	5.775	HRM PRE_PUSH 121907; sheet SUMMARY	9.02E-03	6.220	HRM PRE_PUSH 121907; sheet SUMMARY	-0.445
PM_{10} filter'bl	1.00E-02	6.174	HRM PRE_PUSH 121907; sheet SUMMARY	9.64E-03	6.649	HRM PRE_PUSH 121907; sheet SUMMARY	-0.476
CO	2.29E-04	0.140	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	6.40E-06	0.004	"HRM PRE_PUSH all pollut 013008.xls"; "SUMRY NOX,SOX, CO,VOC" tab.	0.136
VOC	1.83E-04	0.113		1.23E-06	0.001		0.112

PM condensible = PM10 condensible = PM2.5 condensible

PSD and NONATTAINMENT NEW SOURCE REVIEW APPLICABILITY ANALYSIS

	Emission Increases due to C Battery			Emission Decreases due to Retirement of 7-9 Batteries			APPLICABILITY ANALYSIS				
Pollutant	Installation of Battery C	Coal Handling Battery C	Coke Handling Battery C	Retirement of Batteries 7-9	Coal handling Battery 7-9	Coke handling Battery 7-9	Net Emission Change (TPY)	PSD Significant Threshold	PSD Applicability?	NA NSR Significant Threshold	NA NSR Applicability?
NO_x	485.0			1062.2			-577.2	25	NO	40	NO
SO_2	226.7			273.0			-46.4	40	NO	N/A	N/A
VOC	76.5			87.3			-10.7	N/A	N/A	40	NO
TSP	316.5	35.3	16.1	706.4	31.4	13.1	-382.9	N/A	N/A	25	NO
PM_{10}	216.9	15.4	7.6	508.9	13.7	6.2	-288.8	15	NO	N/A	N/A
$PM_{2.5}$	175.6	14.7	7.0	390.0	13.1	5.7	-211.4	N/A	N/A	10	NO
CO	1105.2			1203.8			-98.7	100	NO	N/A	N/A
Lead	0.012			0.012			0.000	0.6	NO	N/A	N/A
H_2S	148.291			277.289			-129.0	10	NO	N/A	N/A
TRS	151.945			300.767			-148.8	10	NO	N/A	N/A

N/A = Not Applicable
NOx, VOC Nonattainment NSR applicability criterion is as precursors to ozone formation

Table C1 - 2 Summary of Emission Calculations

PROCESS	Actual Annual Emissions for BATTERIES 7-9							Future Allowable Emissions for BATTERY C						
	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO	NO_x	SO_2	VOC	PM TOTAL (filt+cond)	PM_{10} TOTAL (filt+cond)	$PM_{2.5}$ TOTAL (filt+cond)	CO
	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year	tons/year
Pre-Push Emissions	0.176	0.623	0.113	11.949	6.174	5.775	0.140	0.006	0.023	0.001	12.869	6.649	6.220	0.004
WITHOUT HOOD														
Pushing Fugitives	0.2	1.3	1.0	5.9	3.2	2.0	0.8	0.2	0.8	0.6	3.6	2.0	1.2	0.5
WITH HOOD														
PEC BH	13.5	50.5	3.1	15.2	7.2	3.5	33.9	15.9	59.5	1.2	33.5	14.9	6.1	38.2
Traveling	10.9	40.6		23.2	8.7	3.2	8.7	6.4	24.1		13.8	5.2	1.9	5.2
PEC fugitives	1.7	6.4	29.8	172.0	95.3	59.1	23.0	0.9	3.5	20.4	119.1	65.8	40.7	16.2
Quenching		10.4	35.5	367.1	297.0	226.9			12.8	43.9	108.3	105.5	102.8	
STACK TOTAL (from Stacks_2006)	1035.0	102.4	6.7	95.8	91.2	89.5	418.0	461.2	91.9	5.0	17.3	16.8	16.6	351.7
Ball Mill				0.015	0.015	0.015					0.017	0.017	0.017	
Soaking	0.6	60.9	3.7	9.2				0.3	34.1	2.1	5.2			
Decarbonization							715.6							691.8
Fugitives														
Doors			6.8	5.5			3.4			2.6	2.2			1.3
Lids			0.0	0.01			0.01			0.1	0.1			0.04
Charging			0.4	0.4			0.2			0.5	0.4			0.2
Offtakes			0.2	0.2			0.1			0.1	0.1			0.1
TOTAL	1062.2	273.0	87.3	706.4	508.9	390.0	1203.8	485.0	226.7	76.5	316.5	216.9	175.6	1105.2

APPENDIX A

MAXIMUM POTENTIAL EMISSIONS
FOR CRITERIA AND HAZARDOUS AIR
POLLUTANTS FOR THE NEW C BATTERY AND
BASELINE ACTUAL EMISSIONS FOR BATTERIES 7, 8 & 9
AT THE U.S. STEEL CLAIRTON WORKS

[Emission spreadsheets and tables in this Appendix are from
Appendix C of the Installation Permit Application for the
Proposed C Battery Project, April 25, 2008]

3. Stoppa et. al.   Costs and Environmental Impact of Dry and Wet Quenching, Cokemaking International, 1/99, 65-70.   Stoppa, H.; Strunk, J; Wuch, G.; and Hein, M; 1999.

according to good engineering and air pollution control practices. The order also sets NO$_X$ emission limitations for the boilers and requires Boilers No. 1 and 2 to install and properly maintain and operate continuous emission monitoring systems

- *Second Consent Decree, Civil Actions Nos.* 79-709, 91-329, December 11, 1992. This decree establishes compliance requirements for Batteries 1, 2, 3, 7, 8, 9, 13, 14, 15, 19, 20 and B. The decree includes requirements for charging, door areas, charging ports and charging port seals, offtake piping, pushing, combustion stacks, quenching, and coke oven gas desulfurization.

- *Consent Order and Agreement for B Battery, June 1, 2007.* This consent order requires that U. S. Steel replace all heating walls on Battery B by June 30, 2010 and demonstrate compliance with the PEC baghouse stack emission limitation of 0.04 lbs of particulate per ton of coke set forth in §2105.21.e.3.

- *Consent Order and Agreement (COA), March 17, 2008.* This order includes requirements for the Clairton Works Batteries 1, 2, 3, 7, 8, 9, 15, 19 & 20 and for the No. 3 Screening Station. Batteries 7, 8 & 9 are required to be shutdown by December 31, 2012 and Batteries 1, 2 & 3 are to be shutdown by December 31, 2014. Prior to the shutdown, the COA requires maintenance activities as described in Appendices A, B, C and D of the COA.

11.0   RECOMMENDATIONS

The provisions of Article XXI, §2102.04.k relating to 'Restrictions on Sources with Violations' does not apply to the issuance of this Installation Permit because paragraph §2102.04.k.1 states that : 'This Subsection does not apply to sources installing air pollution control equipment, or projects that do not increase total potential air emissions of any regulated pollutant at those sources.' This project includes the shutdown of Batteries 7, 8 & 9 and the installation of new C Battery which will result in an overall decrease in total potential air emissions.

It is recommended that this installation permit be approved. All applicable Federal, State, and County regulations have been addressed in the permit application. The installation permit application for the C Battery Project at the U. S. Clairton Works should be approved for construction with the emission limitations and terms & conditions in Installation Permit No. 0052-I011.

REFERENCES

1. U.S. EPA, Compilation of Air Pollutant Emission Factors, Draft Section 12.2: Coke Production, July 2007.

2. U.S. EPA, National Emission Standards for Hazardous Air Pollutants (NESHAP) for Coke Ovens: Pushing, Quenching, and Battery Stacks – Background

Quench Tower

The C Battery quench tower is equipped with baffles and the water used as makeup water for quenching the incandescent coke will be equivalent to or better than the water quality standards established for the Monongahela River per Article XXI, §2105.21.g. The quench tower will be inspected on a periodic basis to determine the condition of the tower and baffles.

9.0 TESTING REQUIREMENTS

Initial compliance testing and routine testing once every two years is required for C Battery combustion stack PM (PM_{10} & $PM_{2.5}$), SO_2 & RATA for NO_X CEMS), the PEC system baghouse stack (PM and Opacity) and the quench tower (PM_{10}, $PM_{2.5}$, SO_2, VOCs).

10.0   APPLICABLE REQUIREMENTS

Allegheny County Health Department Rules and Regulations

Article XXI: Air Pollution Control

Federal Requirements

National Emission Standards for Hazardous Air Pollutants for Source Categories

- **40 CFR Part 63, Subpart L: National Emission Standards for Coke Oven Batteries**

Subpart L sets standards for fugitive emissions from coke oven doors, topside port lids, offtake systems, charging and collecting mains. The standard also requires the installation of a flare for each battery so that coke oven emissions shall not be vented to the atmosphere through by-pass bleeder stacks, except through the flare system. It also specifies work practice standards for the operation and maintenance of coke batteries.

- **40 CFR Part 63, Subpart CCCCC: National Emission Standards for Coke Ovens: Pushing, Quenching, and Battery Stacks**

This subpart establishes emission limitations and work practice requirements for the control of hazardous air pollutants from coke pushing, coke quenching and coke battery combustion (underfire) stacks at new and existing coke oven batteries.

Enforcement Orders and Consent Decrees and Agreements

- *Enforcement Order and Agreement Upon Consent Number 234, Reasonably Available Control Technology (RACT), January 2, 1997.* This order includes requirements that coke batteries, pushing emission control systems, boilers, by-products plant clean coke oven gas blanketing system, SCOT plant incinerator and the wastewater treatment plant be properly maintained and operated

After the first oven is charged, the oven is connected to the collecting main, and the PROven System is ready to serve the battery operation. C Battery will initially be operated at 24 hour coking time. Over the course of the following three months, the coking time will be gradually decreased to an 18 hour coking time, corresponding to "normal operation". This gradual process involves periods of stabilization after each step of coking time decrease.

Charging and pushing schedules are changed at each step of commissioning to match the coking time requirements, until full production is achieved. Once full production is achieved on C Battery, 7 and 8 batteries will be shut down over a 2-to-3 day period. Once 7 & 8 batteries are shut down, the batteries will be demolished, in preparation for the installation of D battery foundations, followed by D battery construction on the 7-9 battery site.

A more detailed explanation of the C Battery heat-up and coke production ramp-up are presented in Appendix C.

7.0   PERMIT APPLICATION COMPONENTS

1. Final Installation Permit Application for the Proposed C Battery Project, prepared for U. S. Steel Corporation by ENSR Corporation, May 5, 2008.
2. Email from C. Davis, USS Clairton Works, 4/9/2008
3. Email from C. Davis, 4/9/2008 with attached description "Self Sealing Coke Oven Door System FLEXZED®"
4. Email from C. Davis, 1/11/2008, attachment "Cost & Environmental Impact of Dry and Wet Quenching" by H. Stoppa, J. Strunk, G. Wuch and M. Hein, Coke Making International, 1/99.

8.0 METHODS OF DEMONSTRATING COMPLIANCE

Various methods are used to demonstrate compliance with ACHD and federal regulations. These methods are summarized below:

C Battery

Daily visible emission observations using Method 303 per 40 CFR 63.04 (40 CFR 63 Subpart L) are used to demonstrate compliance for charging emissions, door leaks, lid leaks, offtake leaks and collector mains. Weekly visible emission observations are also performed for charging, door leaks, lid leaks, offtake leaks, combustion stack opacity, pushing emission opacity and hot car travel. Stack testing is also performed on the combustion stacks (see Section 6.0). Monthly records of coal charged to the battery, coke produced, coke oven gas produced, sulfur content of the coal and coke, total number of pushes, number of controlled pushes, pushing outages and coke oven gas flaring incidents are submitted to the ACHD. The pushing emission control baghouse will be tested every two years for particulate matter and opacity.

6.0   STARTUP PLAN FOR C BATTERY AND SHUTDOWN OF BATTERIES 7, 8 & 9

Heat Up of C Battery

C Battery will be ready for heat-up when the refractory installation is almost complete, except for a few courses of the oven roof section. The oven doors are installed on both the pusher side and the coke side of the ovens. Burners are set up along the pusher and coke side benches. Each oven will have a temporary burner on the pusher side and another on the coke side. Coke oven gas will be used as the fuel for the burners and temporary piping will be installed to supply gas to the burners. For monitoring and controlling the temperature of the refractory, thermocouples will be set up at specific locations. A data collection system is installed to gather the temperature information used for controlling the rise of temperature in accordance with preset heat-up curves which project thermocouple aim temperatures versus time.

During heat-up, the refractory expands. The silica brick, which is located in the hotter areas of the battery refractory structure, expands more quickly than the fireclay, which is located in the cooler, lower areas. There is a provision for expansion joints in the refractory design and installation, which when combined with the battery bracing system, accommodates this differential expansion rate. The bracing systems control the expansion as necessary to achieve the final dimensions and gas tightness of the heated-up refractory structure.

After about 50 days of heat-up, when the refractory temperature reaches and is stable at 1,490 °F, a switch over to using the battery underfiring system and reversing system for heat input takes place, and the external heat-up burners are turned off. In addition to the thermocouple readings, temperature readings will be taken in the flues using infrared pyrometers.

After about 90 days, the flues reach a temperature of 2,100 °F. The heat-up period is over and the battery is ready for charging. At this point in time during the heat-up of C battery, Clairton's No. 9 battery will be shut down, and 7 & 8 batteries will be reduced to about 120 ovens pushed per day (50% of typical full schedule for 7-9), significantly reducing the total emissions from the 7-9 battery unit. The 120 ovens/day schedule enables batteries 7 and 8 to be maintained hot enough to prevent the loss of beneficial sealing carbon and minimizes the development of internal thermal stresses which might otherwise increase oven-to-flue leakage and stack emissions on 7 and 8 batteries.

Ramp Up of Coke Production

The initial operation of the battery during the ramping up of production (from first charge to full production level) is as important to the integrity of the battery refractory as the proper heat-up. The battery is intentionally started at a lower than normal production level to minimize the thermal stresses on the refractory. It will take about three months to safely and efficiently reach full production after the first charge on the new battery.

**Maximum Predicted Pollutant Concentrations and Maximum
Measured Concentrations at Nearby Monitoring Stations**

Pollutant Standard	Maximum Impact (µg/m³)	Maximum Monitored Concentration (µg/m³)	Location of Maximum Concentration	Impact + Max. Monitored Concentration (µg/m³)	NAAQS Standard (µg/m³)	Exceedance of NAAQS
PM10 24-Hour	6.5	129	Lincoln	136	150	No
SO2 24-Hour	13.9	146	Glassport	160	365	No
SO2 3-Hour	62.6	384	Glassport	447	1300	No

The additional impacts due to C Battery would not have caused an exceedance of the NAAQS under worst-case 2002 conditions. Since the worst-case values involve modeled impacts and monitored concentrations that occur on different days and locations, and since long-term monitored PM_{10} and SO_2 levels show decreasing trends, actual future concentrations would likely be lower than the levels shown above.

5.0   SULFUR COMPOUND CONCENTRATION OF COKE OVEN GAS

According to Article XXI, §2105.21.h.2, no person shall flare, mix, or combust coke oven gas unless the concentration of sulfur compounds, measured as hydrogen sulfide in such gas is less than or equal to 10 grains per 100 dry standard cubic feet of coke oven gas for all batteries installed after January 1, 1978. Therefore, C Battery must comply with §2105.21.h.2. The By-Products Plant at the Clairton Works treats all the coke oven gas produced by the 12 batteries. Paragraph §2105.21.h.4 requires that the coke oven gas from the 12 existing batteries meet a sulfur compound concentration of 40 grains per 100 dry standard cubic feet of coke oven gas. To comply with these requirements, the sulfur compound concentration was calculated as the weighted average concentration of the remaining batteries after the shutdown of Batteries 7, 8 & 9 and the startup of C Battery. The design capacity, in terms of annual coal charge, was used as the weighting factor for all batteries. The average sulfur compound concentration calculated using this procedure is 35 grains per 100 dry standard cubic feet of coke oven gas. The following table presents the results of this calculation:

Average H₂S Concentration with the Operation of C Battery

Battery	Annual Coal Charge tons	COG H2S Conc. gr/100 dscf	Coal Charge X H₂S Concentration	Avg. H₂S Concentration gr/100 dscf
Nos. 1 - 3	1,553,805	40	62,152,200	
Nos. 13-15	1,637,025	40	65,481,000	
Nos. 19-20	2,004,580	40	80,183,200	
B	1,491,025	40	59,641,000	
C	1,379,059	10	13,790,590	
Total	8,065,494		281,247,990	**34.87**

4.0   AIR QUALITY IMPACTS DUE TO THE SHUTDOWN OF BATTERIES 7, 8 & 9 AND THE OPERATION OF NEW C BATTERY

Air quality modeling was performed to determine if any adverse air quality impacts may result from the operation of the proposed C Battery and the permanent shutdown of Batteries 7, 8 & 9. Energy and Environmental Management, Inc. (E^2M) performed this modeling on behalf of U. S. Steel. The modeling results were verified by air quality modeling performed by the Department.

The CALPUFF modeling system was selected for this analysis because it is the same model being used by the ACHD for development of the $PM_{2.5}$ State Implementation Plan (SIP). CALPUFF is an EPA-preferred model that is most widely used for long-range visibility modeling, but its incorporation of buoyant plume rise algorithms, gridded upper air meteorology, and complex geophysical processing makes it advantageous for this short-range application.

The Department's review of the modeling submitted by U. S. Steel is presented in Appendix D. This review includes a description of the meteorological data, terrain input and a listing of the sources modeled.

The CALPUFF modeling results indicate that maximum predicted 24-hour concentrations of PM_{10} and SO_2 and the 3-hour concentration of SO_2 exceed the air quality significance levels. These results are presented in the following table along with the air quality significance levels.

Maximum Predicted Ambient Concentrations due to C Battery and the Shutdown of Batteries 7-9

Pollutant Standard	Maximum Impact ($\mu g/m^3$)	Significant Level ($\mu g/m^3$)
PM10 24-Hour	6.5	5
SO_2 24-Hour	13.9	5
SO_2 3-Hour	62.6	25

The maximum PM_{10} and SO_2 ambient air quality impacts listed in the above table were added to the maximum concentrations measured at nearby air quality monitoring stations to determine if the air quality impact of the proposed project may exceed the National Ambient Air Quality Standards (NAAQS) for PM_{10} and SO_2. The area surrounding the U.S. Steel Clairton Works is in attainment for PM_{10} and SO_2. Based on the CALPUFF modeling results, as listed in the following table, the additional impacts due to C Battery will not cause an exceedance of the NAAQS under worst-case 2002 conditions. Actual future monitored concentrations would likely be lower than the summed concentrations presented below.

Fugitives		
NO$_x$	PROven® system, effective work practices	No specific limit
VOCs	PROven® system, effective work practices	No specific limit
CO	PROven® system, effective work practices	No specific limit
SO$_2$	PROven® system, effective work practices	500 ppmvd
TSP, PM$_{10}$, PM$_{2.5}$	PROven® system	2.5% leaking doors; 0.4% leaking top side lids; 1.5% leaking offtakes; 12 seconds of visible emissions per charge 20% instantaneous opacity from push

Traveling		
NO$_x$	Effective work practices	No specific limit
VOCs	Effective work practices	No specific limit
CO	Effective work practices	No specific limit
SO$_2$	Effective work practices	No specific limit
TSP, PM$_{10}$, PM$_{2.5}$	Coke Transfer Car	10% Opacity via VEO

Quenching		
NO$_x$	Effective work practices	No specific limit
VOCs	Effective work practices	No specific limit
CO	Effective work practices	No specific limit
SO$_2$	Effective work practices	No specific limit
TSP, PM$_{10}$, PM$_{2.5}$	State-of-the-art tower and baffle design, employ clean quenching water, daily cleaning of baffles, monthly inspection of baffles	5% maximum of tower cross-sectional area left uncovered or open to the sky, 1,100 mg/L TDS in quenching makeup water

Coke Handling		
NO$_x$	Effective work practices	No specific limit
VOCs	Effective work practices	No specific limit
CO	Effective work practices	No specific limit
SO$_2$	Effective work practices	No specific limit
TSP, PM$_{10}$, PM$_{2.5}$	Effective work practices and baghouse control of screening operations	No specific limit except as specified in a unit-specific BACT determination

removal of dissolved solids. The RO unit will include a water softening column containing a sodium exchange resin, RO feed tank and pump and the RO Unit. The softener unit is included to convert calcium, magnesium and the other di and tri valent cations to the more soluble sodium salts. This will increase RO's operational efficiency and will minimize membrane cleaning operations. The RO permeate will be fed to the quench water storage tank for blending with the river water. Since the RO process will remove all of the dissolved solids, only about one half of the total quench water consumed (470,000 gal/day) will be treated.

The reject from the RO Unit will be combined with the spent regenerant brine from the sodium exchanger. This combined stream will be collected in a storage tank and treated in the evaporator prior to the offsite discharge as a concentrated brine solution. It is estimated that between 15,000 and 20,000 gallons of concentrated brine will be generated every day.

The total estimated installed cost for the quench water treatment system is approximately \$29.2 million. This estimate does not include annual operating costs. Based on this evaluation, the cost to reduce the TDS levels in the river water are prohibitive.

3.12 BACT Determination Summary

A summary of the BACT Determinations for proposed Coke Battery are presented in the following table.

Pollutant	Emissions Control Technology	BACT Emissions Levels

Coking Cycle COG Combustion		
NO_x	PROven® system, staged combustion, byproduct recovery plant removal of nitrogen-containing organic compounds	No specific limit
VOCs	PROven® system, effective combustion	No specific limit
CO	PROven® system, effective combustion	No specific limit
SO_2	PROven® system, byproduct recovery plant desulfurization	10 gr H_2S/100 dscf of COG per §2105.21.h.2
TSP, PM_{10}, $PM_{2.5}$	PROven® system, byproduct recovery plant desulfurization	0.009 gr/dscf, 10 gr H_2S/100 dscf of COG per §2105.21.h.2

Pushing		
NO_x	PROven® system, effective work practices	No specific limit
VOCs	PROven® system, effective work practices	No specific limit
CO	PROven® system, effective work practices	No specific limit
SO_2	PROven® system, effective work practices	No specific limit
TSP, PM_{10}, $PM_{2.5}$	PROven® system, Coke Transfer Car, moveable hood with belt-sealed fixed duct, baghouse, achieving 90% capture efficiency and 99% control efficiency	0.005 gr/dscf and 0.02 lb/ton-coke for PEC Baghouse Outlet

3.10.1   Effect on Air Toxic Emissions from Individual C Battery Sources

For coking cycle COG combustion, the chosen BACT is the PROven® system, byproduct plant removal of nitrogen and sulfur compounds in the COG and LNB-staged combustion system for battery underfiring. The BACT analysis also considered fuel switching to natural gas, SCR/SNCR for NO_x control, flue gas desulfurization, and a baghouse or ESP for particulate control. These alternatives were rejected as too costly, not as effective as proposed BACT or not feasible. Coking cycle COG emissions as presented in Table 1 are insignificant, that is, less than 0.01 tpy. The proposed BACT levels and associated controls will reduce toxic emissions shown in Table 2 by 25%.

For pushing, the greatest control (PROven® system) was chosen for NO_x, VOC and CO. For the remaining regulated pollutants, the chosen BACT was a traveling hood attached to fixed duct vented to baghouse. The BACT analysis also considered emissions captured by a hood then vented to an SO_2 scrubber and/or a baghouse/ESP, emissions captured by a coke-side shed then vented to an SO_2 scrubber and/or a baghouse/ESP and a mobile scrubber car. These alternatives were rejected due to significant environmental, energy and economic impacts. The proposed BACT levels and associated controls for pushing fugitives and for the PEC baghouse will produce less than a 0.01 tpy increase in the pollutants listed in Table 1.

For fugitives (i.e., doors, lids, charging and offtakes), the top level of control was selected for all regulated pollutants (PROven® system and coke transfer car). Additional capture and control and non-recovery battery design were considered and rejected as not technically feasible. The chosen BACT results in greater than a 10 tpy reduction in the pollutants listed in Table 1. The chosen BACT results in a 10% reduction in the toxic air pollutants listed in Table 2 from doors, lids and offtakes and no reduction from charging.

For traveling, no specific controls were selected as BACT. The BACT analysis also considered capturing emissions with a coke-side shed and venting to an SO_2 scrubber and/or a baghouse/ESP and a mobile capture and control system (mobile scrubber car). These alternatives were rejected due to higher overall particulate emissions or not technically feasible (mobile scrubber car). The chosen BACT has negligible effect upon the net changes in Tables 1 and 2. However, the C Battery design results in a 41% reduction in toxics emissions due to shorter travel times between the oven and the quench tower.

For quenching, the top level of control was selected (wet quenching with a tall tower design and chevron-style baffles). Dry quenching was considered but rejected as not technically feasible. The chosen BACT will produce a net increase in the pollutants listed in Table 1 of 0.5 tpy due to additional coke being quenched. The chosen BACT will produce a net reduction in pollutants listed in Table 2 of 19 tpy due to fewer quenches in C Battery compared to 7 - 9 Batteries and better baffle design.

For coke handling, effective work practices and baghouse control of screening operations were selected as BACT. No other alternatives were considered. Better control will reduce particulate emissions by more than 1 tpy. Associated contaminants contained within the coal would be reduced as well

3.11 BACT for Quench Water Treatment Controls

Water from the Monongahela River will be used to quench coke immediately after being pushed from the coke ovens. During the quenching operation some of the dissolved solids (TDS) present in the river water are emitted with the steam generated during the quench. In order to reduce TDS emissions associated with the quench operation, the following options were evaluated to reduce the TDS concentrations in the river water from approximately 600 – 800 mg/l to 300 – 400 mg/l: Reverse Osmosis (RO); Electro Dialysis Reversal (EDR); and Ion Exchange (IE) processes. In general terms, the most common way to reduce TDS is to use membrane technology such as RO.

This option is based on the assumption that membrane filtration will provide long term operational consistency in removal of dissolved solids from the river water. Feed to the RO unit will be effluent from the existing river water treatment system. It is assumed that the river water will be filtered prior to the RO treatment.

The RO process could be used to remove dissolved organic compounds; however, the long term viability of this alternative must be evaluated at pilot scale. It is therefore necessary to use granular activated carbon (GAC) to remove soluble organic compounds prior to the RO unit. Filtrate from the GAC unit will be fed to a RO unit for

Table 2

Net Changes in Toxic Air Pollutant Emissions Due to the C Battery Project

Pollutant	Net Change
1,1-Biphenyl	0.0006
Ammonia	-15.5076
Anthracene	0.0034
Antimony	-0.2810
Benzo(a) Anthracene	0.0004
Benzene	-0.2503
Chromium Compounds	-2.8041
Chlorine	-0.0216
Hydrochloric acid	-0.9087
Chrysene	0.0019
Cobalt	-0.1432
Coke Oven Emissions	0.0274
Cresols	0.0271
Cyanide Compounds	0.1094
Dibenzofuran	0.0020
Ethylbenzene	0.0000
Ethylene	-0.0209
Fluoranthene	0.0019
Mercury	-0.0014
Naphthalene	-0.1718
Nickel	-0.3523
Phenanthrene	0.0043
Phenol	0.1173
7-PAH	0.0006
POM	-0.0044
Pyrene	0.0016
Quinoline	0.0019
Styrene	0.0000
Toluene	-0.0186
Xylene	-0.0023
TOTAL	**-20.1885**

Table 1 - Net Changes in Emissions of Lead, H_2S, CS_2 and TRS due to the C Battery Project

	7-9 Battery		C battery	
BSO charging EF	0.0029	lb/(secVE/chg)/hr	0.0035	lb/(secVE/chg)/hr

	TPY Values							
	Lead		Hydrogen Sulfide		Carbon Disulfide		Total Reduced Sulfur	
7-9 Batteries	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	9.355E-03			4.200E-05	2.568E-02		2.57E-02
Traveling	1.530E-06	9.355E-04			4.220E-06	2.580E-03		2.58E-03
PEC fugitives	2.509E-06	1.534E-03			5.750E-06	3.516E-03		3.52E-03
Uncontrolled pushing	5.480E-05	1.833E-04			4.800E-05	1.605E-04		1.61E-04
Quenching					5.490E-03	3.357E+00		3.36E+00
7-9 STACK TOTAL					3.150E-03	5.27E-03		5.27E-03
Ball Mill								
Soaking (lb/push)			1.700E-01	1.054E+01				1.05E+01
Decarbonization								
Fugitives			EF	TPY	EF	TPY		TPY
Doors			0.138	0.138	0.001	0.001		1.72E+01
Lids			4.800E-03	4.800E-03	3.200E-05	3.200E-05		4.83E-03
Offtakes			4.770E-03	4.770E-03	3.200E-05	3.200E-05		4.80E-03
			sec/chg	tons/year	sec/chg	tons/year		tons/year
Charging			5.600E-01	1.423E+01	1.180E-01	2.998E+00		1.72E+01
TOTAL		1.201E-02		2.491E+01		6.393E+00		4.839E+01
C Battery	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year	lb/ton coal	tons/year
PEC BH	1.530E-05	1.052E-02			4.200E-05	2.887E-02		2.89E-02
Traveling	9.088E-07	6.248E-04			2.507E-06	1.723E-03		1.72E-03
PEC fugitives	1.530E-06	1.052E-03			5.750E-06	3.953E-03		3.95E-03
Uncontrolled pushing	5.480E-05	1.134E-04			4.570E-05	9.453E-05		9.45E-05
Quenching					5.254E-03	3.612E+00		3.61E+00
C STACK					2.363E-03	7.23E-03		7.23E-03
Ball Mill								
Soaking			8.500E-02	5.911E+00				5.91E+00
Decarbonization								
Fugitives			EF	TPY	EF	TPY		TPY
Doors			0.069	0.035	0.000	0.000		3.47E-02
Lids			4.320E-03	3.888E-03	2.880E-05	2.592E-05		3.91E-03
Offtakes			4.293E-03	3.864E-03	2.880E-05	2.592E-05		3.89E-03
			sec/chg	tons/year	sec/chg	tons/year		tons/year
Charging			5.600E-01	1.717E+01	1.180E-01	2.998E+00		2.02E+01
TOTAL		0.012		5.953		3.654		9.607
NET CHANGE (C minus 7-9)		3.002E-04		-1.896E+01		-2.739E+00		-3.878E+01

The proposed wet quenching system featuring a tall tower design with Kiro-Nathaus chevron style baffles as discussed in Section 3.5.1 represents LAER and BACT for VOC, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions control for C Battery quenching operations.

3.9 BACT for C Battery Coke Handling

Emissions from coke handling will be minimized by applying a surfactant to suppress dust formation, and the proposed installation of a new screening station to serve B Battery and proposed C and D Batteries. If a new screening station is to be installed, the permittee will be required to submit a separate installation permit application for the anticipated new coke screening station.

A BACT analysis for the emission controls for the new screening station will be included with the Installation Permit Application for D Battery. There are no NSPS or NESHAPs that are applicable to coke handling. The use of a surfactant to suppress dust formation and the proposed new screening station and associated emission control systems represent BACT for coke handling.

3.10 BACT for Unregulated Air Pollutants

The C Battery project will result in net reductions of every regulated and unregulated air toxic and hazardous air pollutant known to be emitted from Clairton Works' coke oven batteries. Table 1 presents a summary of emissions of lead, hydrogen sulfide (H_2S), carbon disulfide (CS_2) and total reduced sulfur (TRS) for 7 - 9 Batteries and C Battery. The net reduction of these pollutants in tons per year (tpy) is shown at the bottom of the table. Emissions of lead will increase imperceptibly by 0.0003 tpy. Emissions of H_2S, CS_2 and TRS will be reduced by 129 tpy, 2.7 tpy and 149 tpy, respectively.

Table 2 presents a similar summary for all other toxic pollutants known to be emitted by the coke oven batteries at the Clairton Works. The Project will produce a net reduction in every one of these pollutants and will produce a total net decrease of 20 tpy of the pollutants listed in Table 2.

located in regions which suffer from long periods of severe cold, such as for example: Siberia, Finland, Poland, where wet quenching of coke is difficult or even impossible."

In reference to the coke dry quenching (CDQ) system, USEPA's BID notes that "[T]here are no visible emissions" and that "heat from the hot coke is recovered with minimum operating costs". The USEPA's BID also discusses the Kress Indirect Dry Cooling system that was demonstrated at the Bethlehem Steel Corporation Sparrows Point mill in 1991, which reportedly "looks promising for the reduction of pushing and quenching emissions" (while not stated by USEPA, this would also be a means of controlling traveling emissions), but that the demonstration identified some problems with the technology that were not resolved while it was being tested. A search of the open literature did not identify a single case in which the Kress technology has been applied other than the cited demonstration at Sparrows Point, and therefore it cannot be considered as an available option for this application.

A documented instance of the commercial application of CDQ can be found at the Kaiserstuhl Coke Plant in Dortmund, Germany. Stoppa et al., 1999[3] discusses the relative merits and demerits of dry quenching observed at this facility. According to studies conducted at this plant, the dust emissions (PM emissions) range from 15-50 grams/ton-coke for a wet quenching system compared to 1-20 grams/ton-coke for a dry quenching system. While this exhibits a clear advantage of the dry quenching system as opposed to the wet quenching system for abatement of PM emissions, the same study showed that dry quenching process results in significantly higher quantities of gaseous pollutants such as SO_2 and CO. This fact makes it difficult to identify the better of the two technologies. For those and possibly other reasons, the CDQ process at the Kaiserstuhl plant was shut down: the Kaiserstuhl plant itself was shut down subsequent to the discontinuation of the CDQ process. There are in fact no other dry quenching plants known to be in operation at this time in Europe. As indicated above, the LEQ tall wet quenching tower design featuring chevron-style baffles was developed for plants such as Kaiserstuhl to meet the same emissions limits as were met by dry quenching but without the other detriments.

Another obvious concern regarding dry quenching is that while this will reduce water consumption for a coke oven battery by a significant amount, this advantage may be outweighed by the associated raw material consumption and other system demands of a CDQ system as well as the attendant indirect emissions. The establishment of a dry quenching process at Clairton would require a large area of real estate which is not available in the current scenario.
Also, the coke dry quenching process requires a backup wet quenching process during occurrences of downtime and there is an increased risk of powdering and combustion of the coke during dry quenching thus decreasing the coke yield. Moreover, the cost benefit ratio comparison conducted at Kaiserstuhl revealed that whereas a CDQ system can be installed at $60-$90 per annual ton coke produced, a wet quenching system accomplishes the same task at less than a quarter of the value ($15 per annual ton coke produced). The cost of labor and material amount to $13 million for CDQ compared to $5 million for a wet quenching system. Furthermore, revisions of CDQ (that occur every 3 years) cost another $2.5 million whereas no such revisions are required for a wet quenching system.

Dry quenching of coke facilitates the recovery of the sensible heat of coke and uses that energy to make steam which can be traded to earn proceeds. As such, a clear determinant of the profitability of the coke plant employing dry quenching lies in the domestic prices of energy. In countries such as Japan, where energy prices are high, it is more cost effective to have a CDQ system. In the U.S.A, where energy prices are much lower, wet quenching systems make for more profitable operations.

Considering the level of emissions that will be associated with the C Battery quenching operation, the significantly higher costs that would be associated with employing a dry quenching system make this an unacceptable choice in this case. For these reasons, employing a dry system design as a means to reduce quenching emissions was rejected as BACT for this application.

3.8.2   BACT Determination for C Battery Coke Quenching

emissions are controlled by equipping the towers with baffles, limiting the total dissolved solids (TDS) level of the quench water, and adhering to a specified schedule for baffle inspections and cleaning.

- No information was found that indicated that limits are imposed on any coke oven batteries for quenching emissions of pollutants other than particulate matter and visible emissions.

- The proposed C Battery quench tower design and associated operating and maintenance procedures will be equivalent or superior to those employed at the best-controlled quench towers in the United States.

VOC, SO_2, TSP, PM_{10}, and $PM_{2.5}$ emissions from quenching are attributable to the generation of dust by the mechanical operation of depositing the large volume of water on the incandescent coke. The nature of the quenching operation, involving a large volume of water-saturated air containing relatively low levels of entrained particulate matter, precludes the consideration of the ESPs, scrubbers, and baghouses that are used for other (even large-scale) sources of particulate emissions. The technology options for coke quenching that were identified for this evaluation include:

- Tall quench tower with chevron baffle design

- Dry quenching

Tall Quench with Chevron Baffle Design
The quench tower and settling basin proposed for C Battery will be designed with a state-of-the-art Kiro-Nathaus baffle system which will be the first of its kind to be installed in the United States. The system consists of louver-like baffles arranged in a chevron pattern. The baffles will control the particulate/VOC emissions by mechanical deflection and electrostatic adsorption. This technology is not new, but it has been substantially improved by adding a second set of baffles. The lower set of baffles will be constructed from stainless steel, while the upper set will be constructed from polypropylene. This Low Emission Quench (LEQ) was designed to meet the particulate emissions standard for dry quenching in Germany while avoiding the issues associated with dry quenching.

A second mist suppression spray, located just below the baffles, will help the dust particles suspended in the stream act as condensation cores around which droplets will form that will either precipitate on the louvers above, or descend downward. The quench tower will also be taller than the existing Battery 7 - 9 quench tower, in order to achieve the required draft for the second set of baffles. One other emissions reduction benefit of the new quench tower will be that it will replace the current auxiliary quench tower for B Battery, and thus to the extent it is used for that battery will represent a substantial improvement for emissions control.

The quench sump for for C Battery will be larger than Batteries 7 – 9 quench sump for better settling and thus cleaner recirculation water. It will also have a rake to remove settled solids.

Dry Quenching
A dry quenching system involves substituting an inert gas such as nitrogen for water for cooling the coke. According Chapter 10 of to STAPPA/ALACO's March 2006 report "Controlling Fine Particulate Matter Under the Clean Air Act: A Menu of Options," "some plants in Europe have switched from water quenching to dry quenching to limit emissions of PM and VOCs," but this does require major construction activities and associated costs." More specifically, the "European Commission (EC) estimates that a dry quenching plant may cost between 10 and 15 times more than a wet quenching station" and that dry quenching processes were generally "intended for application in coke oven plants

Relatively little information concerning the controls applied to coke oven battery traveling emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse. The most notable findings were as follows:

- For byproduct recovery coke oven batteries and also for the non-recovery coke oven batteries, only visible emissions from traveling are addressed.

- No emissions control measures are identified for traveling emissions.

3.7.1 Emission Controls for Hot Car Travel

Use of a coke–side shed to capture emissions and a baghouse to control emissions were discussed previously in Section 3.2. Employing this type of system would mean that the proposed pushing emissions control system, consisting of a traveling hood attached to a fixed duct vented to a baghouse, would not be employed. The net result of that would be higher overall emissions of TSP, PM_{10}, and $PM_{2.5}$ because the proposed pushing emissions control system will be more efficient than a coke-side shed even when the traveling emissions capture aspect is included. The higher overall particulate emissions for the coke-side shed option is considered an unacceptable environmental impact, and on that basis, this option was rejected as BACT for this application.

For C Battery, there will be a new hot car and quench tower. Hot car travel-related emissions will be lower than those from Batteries 7 - 9 for several reasons. There will be fewer trips traveling to the quench tower because there will be significantly fewer ovens to push in C Battery than in Batteries 7, 8 & 9. Travel distance to the C Battery quench tower will also be less, resulting in fewer trip miles per year. Also, the C Battery hot car will be larger than the hot car for Batteries 7 - 9. The coke in the larger C Battery hot car will have greater surface area exposed to the atmosphere, thus higher emissions per car. However, the larger hot car will have a smaller surface area to volume ratio, thus emitting less pollutant per volume or per ton of coke in the hot car. The net effect is lower annual emissions from C Battery traveling.

3.7.2 BACT Determination for C Battery Traveling

Traveling emissions for C Battery will be reduced by use of a larger hot car and the fewer trips and shorter travel distance from the battery to the quench tower.

3.8 BACT for C Battery Quench Tower

Incandescent coke, after it is pushed from the ovens, is transported by means of a quench car or hot car to a quench tower. Quenching of incandescent coke minimizes it from burning from further exposure to air. As part of the C Battery Project, the quench tower for Batteries 7, 8 & 9 will be shut down along with the B battery auxiliary quench tower which will be demolished. A new quench tower will be installed for the C Battery. This new quench tower will also serve as the auxiliary quench tower for Battery B.

3.8.1 Available Control Technologies for Coke Quenching

Based on the information found in the USEPA's BID[2], RBLC, California BACT Clearinghouse, and other information referred to in U.S. Steel's Installation Permit Application relative to quenching emissions control, the following control techniques were identified:

- Quench towers serving byproduct recovery and non-recovery coke oven batteries that are either currently in operation or are expected to operate in the future in the United States, quenching

3.6.1 Top-Down Assessment of Control Technology Options for Bypass COG Emissions

The following technology options were identified for this BACT evaluation:

- Direct flame incinerators: Consists of a combustion chamber in which the VOC containing stream (raw COG stream) is combusted. Streams containing H_2S will also be oxidized to produce SO_2 and SO_3. External thermal energy needs to be supplied in order to raise the temperature of the gas stream to its ignition temperature in order for it to combust. These thermal units are designed to have a nozzle-stabilized flame at their center that is sustained by means of using an auxiliary fuel (possibly natural gas). The waste gas stream passes through this flame and gets heated to its ignition temperature. The VOCs and the H_2S in the stream get oxidized. The exhaust stream, that still contains some heat, can be routed to a heat exchanger, which can act as a pre-heater for the raw COG stream.

- Regenerative Thermal Oxidizer (RTO): This set-up also contains a combustion chamber where the waste stream is heated to its ignition temperature. The fundamental difference between the RTO and the direct flame incinerator is that the RTO contains a heat recovery unit that collects residual heat from the waste stream.

- Catalytic Thermal Oxidizer (CTO): Consists of a combustion chamber in which a catalyst is used to increase the rate of the combustion reaction so that oxidation may become possible even at low temperatures. However, the stream to be treated must be heated to a sufficiently high temperature to initiate the oxidation reactions. Use of a catalytic incinerator is possible only with streams containing specific chemical species. Some compounds such as sulfur and chlorine can have a poisoning effect on the catalyst and particulate matter can blind the pores of the catalyst surface deactivating it over time.

- Emergency flare: Flaring is a combustion control technique applied to VOC in which the VOCs are piped to an elevated location and burned in an open flame. A burner tip, some auxiliary fuel and steam or air for good mixing are essentials for achieving good oxidation efficiency.

3.6.2 BACT Determination for By-Pass COG Emissions

All of these technologies have control efficiencies of at least 99%; however, the reliability and adaptability of a direct flame incinerator, regenerative thermal oxidizer or catalytic thermal oxidizer to this function is less than an emergency flare. These other systems are also less cost effective than an emergency flare. Venting of raw COG from the exisitng batteries at the Clairton Works occurs very infrequently and the installed flare systems have performed as designed by igniting and flaring the raw COG prior to release to the atmosphere. Installing a system that has not been applied to this specific function may result in a significant increase in the quantity of raw COG being vented to the atmosphere prior to treatment.

Based on the foregoing discussion, an emergency flare system was determined to be BACT for emissions associated with the emergency by-pass of raw COG.

3.7   BACT for C Battery Traveling

After the coke is pushed into the hot car, the hot car travels to the quench tower. Batteries 7 - 9 all use the same quench tower. During travel the hot car is uncovered and emissions to the atmosphere consist mainly of particulate released as part of the hot air rising from the coke in the car. Smaller amounts of SO_2, NO_X, CO and other pollutants are also released. After the carbonization process is complete, all of the volatile matter in the coal has been removed and the only emissions are due to the incandescent coke being contacted by the atmosphere. Controlling these emissions for the relatively short time period while the hot car travels to the quench tower would not be cost effective.

3.5.2   Technical Feasibility Assessment

The following control alternative were assessed:

- Following Good Combustion Practices is technically feasible for this application for abatement of decarbonization emissions. Allowing sufficient time for the complete oxidation of carbon to CO_2 as well as allowing sufficient air into the oven to complete the combustion, are two important aspects of minimizing CO emissions. This system was developed specifically to address byproduct coke oven battery fugitive emissions, and represents a significant advancement in this state-of-the-art for byproduct coke oven batteries.

- Additional capture and control during decarbonization, using an oxidation catalyst, is not technically feasible for this application. There are three primary reasons for this:

  First, it is unlikely that a capture system can be designed, operated, and maintained for this particular application. Only about two of the 84 ovens will be opened at a time to burn off the excess carbon stuck to the interior of the oven. It would be extremely complex to design a capture system that would be capable of serving any two out of 84 ovens at any given time.

  Second, it is unlikely that the captured decarbonization emissions will be within the temperature range of 600°F to 1000°F that is required for effective conversion using an oxidation catalyst. it is expected that the exhaust streams from the decarbonization process will be highly variable in temperatures due to the different quantities of coal combusted in each oven. If the stream were at a temperature above the acceptable range, it would need to be cooled. This would require input of enough dilution air. Input of dilution will reduce the concentration of CO in the stream, which will likely bring the concentration below acceptable levels at times. If the stream is too cool, it would need to be heated. This would require that the system include a burner, which would generate its own emissions, offsetting the emissions reduction for the system.

  Third, the levels of sulfur compounds present in the deposits in the ovens would be high enough that formation of SO_2 and SO_3, acid gases, and catalyst poisons would be unavoidable for this application. Additionally, decarbonization will generate a relatively low level of particulate matter emissions, even a low level of particulate will likely deposit on the catalyst and blind its pores, deacativating it over time.

Based on the above discussons, good combustion practices are BACT for coke oven decarbonization emissions.

3.6 BACT for C Battery Coke Oven Gas Emergency By-Pass

During process upsets it may be necessary to vent raw coke oven gas (COG) to the by-pass/bleeder stacks. According to 40 CFR Part 63, Subpart L, at §63.307(a)(2) "Coke oven emissions shall not be vented to the atmosphere through by-pass/bleeder stacks, except through the flare system or the alternative control device described in §63.307(d)." The existing batteries at the Clairton Works are all equipped with a flare system that will ignite the raw coke oven gas prior to it being released to the atmosphere. These flares use a pilot flame to ignite the raw COG.

3.5 BACT for C Battery Decarbonization

Decarbonization is the process by which the excess carbon is removed from the interior of the oven by opening the topside lids and burning off the carbon. This usually occurs when the oven observer finds that there is considerable accumulation of unburned carbon on the oven surface. The emissions from the decarbonization process primarily consist of CO, with trace quantities of other criteria pollutants and HAPs. CO emissions result from incomplete combustion. As the CO emissions exit the standpipe they are converted to CO_2.

3.5.1 Proposed C Battery Decarbonization Emissions Control Technologies

Minimization of decarbonization emissions relies on good combustion practices that involve controlling CO emissions by limiting CO formation through the design and operation of the battery underfiring system. In general, the combustion control system seeks to maintain the proper conditions to ensure complete combustion through one or more of the following operation design features: providing sufficient excess air, sufficient residence time, good air-fuel mixing, and staged combustion to complete burnout of products of incomplete combustion. Decarbonization emissions from the C Battery will be lower than the decarbonization emissions from 7 - 9 Batteries because C Battery will have less internal surface area, which in turn means there will be less area on which excess carbon would deposit.

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for the coke oven decarbonization sources. There are no specific control requirements for coke oven decarbonization emissions in any NSPS, NESHAP or Article XXI. No information concerning the controls applied to coke oven battery decarbonization emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR.

3.5.1 Top-Down Assessment of Control Technology Options for Decarbonization Emissions
Identification of Available Control Technology Options

The following technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

- Good combustion practices

- Additional capture and control (Oxidation Catalyst)

Oxidation catalysts are employed in certain types of combustion units, principally natural gas-fired combustion turbines. These catalysts are passive systems (i.e., they are not combined with reagent injection such as is used in a selective catalytic reduction system for NO_x emissions control) that, at a sufficiently high temperature, promote oxidation of CO (and VOCs) contained in flue gas in the presence of oxygen to CO_2 and water vapor. The catalyst serves to lower the temperature and residence time (in comparison to un-catalyzed oxidation) required for the oxidation reaction. Under proper conditions, an oxidation catalyst can achieve a substantial reduction in CO emissions. However, the catalyst needs to be located at a point where the gas temperature is within an acceptable range. The effective temperature range for CO oxidation is between 600°F and 1,000°F. Effective reduction by an oxidation catalyst also requires a sufficient concentration; if the concentration is too low, there will be little to no conversion. Catalyst non-selectivity is a problem when sulfur compounds are present, because the catalyst would promote oxidation of sulfur compounds to SO_2 and SO_3. Formation of SO_2 and SO_3 will in turn result in formation of acid gases and other corrosive compounds that will foul and deactivate the catalyst. This would be issue for a coke oven due to the sulfur contained in the coal used for coking.

increase concentrations to go above the high explosive limit). The combustion of the stream to ensure safety will generate its own emissions that would not be generated otherwise. Those emissions would reduce the overall control efficiency of the capture and control system. In addition, supplementary fuel usage would add a potentially significant cost to this system.

- Another issue that would be created by installing such a system is that by manifolding the standpipes, the soaking emissions will no longer be visible. The operator would no longer be able to determine when these emissions are being generated, unless an analyzer (i.e., a continuous H_2S emissions monitor) was installed on each outlet. Such analyzers are expensive and have their own operating and maintenance procedure requirements. The alternative to installing 84 H_2S analyzers would be to design a system to vent to the scrubber at all times. If this were done, then it would eliminate the possibility that the emissions could be routed to the COG collection main, which means that the potential benefit of being able to recover additional COG would be lost. There would be an economic and emissions impact associated with this issue as well.

- Finally, the fans operated to vent the emissions to the scrubber, and fans and pumps for the scrubber itself, would consume a significant amount of electric power. This would also add significantly to the overall cost of the system. There would also be indirect emissions generated to supply that power for the system, which again would reduce the overall control efficiency of the capture and control system.

The option of adding a capture and control system to the PROven® system is not considered to be as effective as employing the PROven® system by itself. This conclusion is based on the judgment that the amount of emissions that would actually be vented to a scrubber would likely be small, and would be more than counterbalanced by the generation of emissions associated with operating a capture and control system. The reason that the amount of emissions that would be vented to a scrubber would likely be small is that even if a capture system were installed, it would be more advantageous to route those emissions back to the collection main for byproduct recovery, where use of their contents can be derived, rather than sending the emissions to the scrubber where they will simply be neutralized and disposed. Even if all of the emissions were routed to the scrubber, a system for this application would be enormously complex, require a huge amount of power consumption, and would require a considerable amount of supplementary fuel burning and injection to prevent an explosion hazard. The supplementary fuel burning would generate emissions directly, and the power consumption would result in indirect emissions generation. It is evident that the combination of direct and indirect emissions generation associated with the capture and control system will far exceed the amount of emissions reduced, for the small amount of time that the emissions would be routed to the scrubber and not to the collection main.

The same detriments to employing a capture and control system in combination with the PROven® system would apply to using a capture and control system only, and therefore using this option on its own is also not considered to be as effective as employing the PROven® system by itself.

Since the option of either adding a capture and control system to the PROven® system or employing capture and control only are not considered to be as effective, employing the PROven® system in combination with battery underfiring, effective work practices, and standpipe igniters, represents the top-ranked option for reduction of soaking emissions. This is the option that was selected as BACT to control the C Battery soaking emissions.

3.4.3   State-of-the-Art for Emissions Control for Soaking Emissions

No information concerning the controls applied to coke oven battery soaking emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR.

3.4.4   Top-Down Assessment of Control Technology Options for Soaking Emissions

As indicated above, no specific controls for soaking emissions were identified in the examination of the current state-of-the-art technology for coke oven batteries; however, the following technology options, including emissions control technologies applied to other types of emissions units that could be considered for technology transfer to this application, were identified for evaluation:

The PROven® system; and

Capture and control, venting to an acid gas scrubber.

The PROven® system is technically feasible for this application. As indicated above, with the PROven® system, the collector main will always be maintained under negative pressure. Even if the oven does not damper off properly, air will be sucked into the collector main instead of gases backflowing from it. This system was developed specifically to address byproduct coke oven battery fugitive (including soaking) emissions, and represents a significant advancement in this state-of-the-art for byproduct coke oven batteries

A capture and control system that vents to an acid gas scrubber may be technically feasible but no such system is known to be installed anywhere for a coke oven battery. An acid gas scrubber is the only available type of air pollution control device capable of effectively controlling both H_2S and SO_2, which will be the predominant components of the emissions stream it would handle, and in addition it can control some particulate matter as well. There are no NO_x, VOC, or CO emissions control technologies (such as a selective catalytic reduction system or oxidation catalyst) that can considered for this particular application. The extent of the design, operating, emissions, maintenance, and cost issues associated with this capture and control system, as summarized below, are completely unknown. There is no evidence to suggest that the combination of issues can be overcome successfully to achieve control of emissions of this nature.

- The configuration of such a system would involve connecting each of the C Battery's oven standpipes to a manifold that would route the emissions to a single scrubber. A system designed to simultaneously handle the emissions from this many ovens, all in various stages of the coking cycle, venting to a scrubber that would be sized to handle only a small fraction of the ovens simultaneously, would have to be equipped with dampers and process control instrumentation that would ensure that the flow to the scrubber is properly regulated while avoiding the creation of too much backpressure that would adversely affect oven operation. The complexity and cost of such a system would unquestionably be enormous.

- The system design will need to ensure safe operation. This will be a particular challenge because the emissions stream will include combustible gases mixed with oxygen in concentrations that will vary widely from moment to moment. It is likely that at many points in time within the manifold, the mixture will be within the explosive concentration range. For that reason, to ensure safety, the system design will need to include controlled ignition, probably supported by supplementary fuel burning (when concentrations are below the combustible concentration range) and possibly also involving direct injection of fuel (to

3.4.1 Proposed C Battery Soaking Emissions Control Technologies

C Battery soaking emissions will be minimized through the employment of the PROven® system, the battery underfiring system, more focused work practices, and standpipe igniters. The PROven® system will minimize soaking emissions by allowing the oven to operate under a lower positive pressure than the 7 - 9 Batteries. By increasing the suction of the collection main, more COG will be routed into it and as a result it is expected that the issue of COG backflowing to the standpipes due to damper leakage will essentially be eliminated.

The underfiring system will improve the efficiency of transfer of heat to the coke in the C Battery in comparison to that of 7 - 9 Batteries, which will result in a reduction in the amount of times that the oven is isolated before the coking cycle has been completed, and therefore reduce the soaking emissions attributable to that issue. The C Battery underfiring system will also be easier to maintain than the 7 - 9 Battery coking cycle COG combustion systems, and that will also result in fewer incidents of incomplete coking.

For the C Battery, similar to what is done for the 7 - 9 Batteries, soaking emissions will also be minimized through work practices that will be initiated when the Lidman observes the standpipe to check for visible emissions and takes action when visible emissions occur. It is expected that the issue of damper leakage as a cause of soaking emissions will be largely eliminated by the PROven® system, the work practices to be employed for the C Battery will be different from those applied to 7 - 9 Batteries, because they will be focused more specifically on the issue of incomplete coking. When soaking emissions are observed on the C Battery, the Lidman will be instructed to first switch the damper to reopen the COG collection main for a prescribed amount of additional time, allowing the coking cycle to proceed further towards completion. Following that prescribed amount of additional time, if soaking emissions are observed to continue, the Lidman will be instructed to activate the igniter in the standpipe

The proposed employment of the PROven® system in combination with the battery underfiring system, effective work practices, and the standpipe igniters will simultaneously control all soaking emissions pollutants, including H_2S, SO_2, TSP, PM_{10} and $PM_{2.5}$, NO_x, VOCs, and CO.

3.4.2 BACT Baseline - Applicable Emissions Control Standards for Soaking Emissions

The minimum requirements for BACT are the applicable federal, state, and ACHD emissions control requirements for the cited coke oven soaking sources, which are as follows:

- There are no NSPS applicable to coke oven soaking emissions. In fact, there are no applicable NSPS for any elements of the operation of a coke oven battery except for coal handling.

- The NESHAPs for Coke Ovens: Pushing, Quenching, and Battery Stacks, set forth in 40 CFR Part 63, Subpart CCCCC, sets standards for soaking emissions, effective on April 14, 2006. §63.7294 specifies work practice standards which require that a written plan be developed, and personnel trained to follow, a set of procedures to ensure the minimization of emissions, including certain specific procedures spelled out in this section. General, initial, and continuous compliance requirements (monitoring, testing, recordkeeping, and reporting procedures) are set forth in §63.7310 through §63.7351.

- For H_2S, SO_2, TSP, PM_{10} and $PM_{2.5}$, NO_x, VOCs, and CO emitted as a result of soaking, there are no specific emissions control requirements or emissions limits specified under Article XXI.

- For leaks from doors, topside port lids, and offtakes, the most common emissions limit approach is to set a limit on the percentage of overall doors and lids that are generating visible emissions at a given point in time.

3.3.2   BACT Determination for C Battery Fugitive Emissions

Fugitive emissions of NO_X, VOC, CO, SO_2, TSP, PM_{10}, and $PM_{2.5}$ from coke oven doors, charging port lids, offtakes, and the coke oven gas collection main are attributable to the emission of COG, coal dust, and coke dust from the oven during and after the coking cycle, before the coke oven doors are opened. Because both the mechanism of emissions formation and the approaches used to minimize/control the emissions of these pollutants are the same, BACT for all pollutants were addressed concurrently.

As described Section 3.3.1, BACT for fugitive emissions includes the PROven® system which will significantly reduce leaks from oven doors, charging port lids, offtakes and the gas collecting main by maintaining the collector main under suction and the oven under a very low and relative constant positive pressure.   Door leaks will also be controlled by employing FLEXZED® design flexible seals, which provide improved gas tightness relative to conventional types of metal door seals.   In addition, fugitive emissions minimization will be enhanced by employing Uhde's CONTROLPRESS battery bracing system, which enables the required pre-stressing and gas tightness of the refractory walls of the ovens under varying operating conditions, and the FLEXZED® design flexible seals that provide gas tightness for oven doors.

Use of these fugitive emission controls will ensure compliance with the emission limitations in 40 CFR Part 63, Subpart L [§63.304(b)(3)] and §2105.21(a).

3.4   BACT for C Battery Soaking Emissions

Soaking emissions are those that are generated in the period between the end of the coking cycle and the beginning of pushing.   The coking cycle is typically ended after a prescribed period of time that is intended to be long enough to ensure that the evolution of COG from the coke has been completed.   When this point has been reached, the coke is ready to be pushed. Before the coke oven doors are removed and pushing can occur, the oven must be isolated from the COG collection main, and the coke car and PEC system capture hood must be brought into position. During this time, to relieve pressure within the oven, the hot gas in the oven space above the coke needs to be vented. To do so, those gases are routed to the atmosphere through standpipes located on the top of the oven. For the C Battery, each oven will be equipped with one standpipe, and each oven will be equipped with a damper that will swing between the collection main and the standpipe, opening one while it closes the other.

At most times, the gases that are routed to the atmosphere through the standpipes are comprised almost exclusively of CO_2, with low concentrations of CO and very low concentrations of other pollutants. On an infrequent basis, however, due primarily to the moisture content of the coal that is charged to an oven, the isolation of the oven after the prescribed period of time will occur before the completion of COG evolution. During such times, the remaining COG that is evolving will vent to the atmosphere through the standpipes. In a conventional coke oven, there will also be infrequent occasions in which COG will leak back through the damper closing the collection main and vent through the standpipes. Thus, when reference is made to soaking emissions, it refers specifically to the emission of uncollected COG. COG contains H_2S and SO_2, and also contains lower amounts of TSP, PM_{10} and $PM_{2.5}$, NO_x, VOCs, and CO. When the gases routing out of the standpipes contain almost all CO_2 and not COG, they are not visible. When COG is being emitted, however, the soaking emissions become visible.

level required for a coke oven battery pushing emissions control baghouse. The PEC baghouse will have an outlet particulate grain loading of 0.005 gr/dscf or less.

3.3 BACT for C Battery Coke Battery Fugitives

Fugitive emissions of NO_X, VOC, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$, which are attributable to the release of COG, and coal and coke dust, are generated during charging, decarbonization, soaking, and during the coking cycle due to leaks from coke oven doors, charging port lids, offtakes (at the connections to the ovens and at the standpipe caps), and the coke oven gas collection main.

3.3.1 Proposed Emission Controls for C Battery Fugitive Emissions

The proposed approach for minimization of these emissions centers on the PROven® system, which represents the current state-of-the-art for minimizing coke oven fugitive emissions. In addition to the PROven® system, controls that will be employed to minimize fugitive TSP, PM_{10} and $PM_{2.5}$ emissions will include the following:

- Charging emissions will be minimized by stage charging, which ensures that the oven is not overfed and that the feed rate of the coal permits capture by the exhaust system. The mechanisms that will be used to accomplish this include equipping the larry car with screw feeders and specially designed drop sleeves. Steam aspiration will not be required during charging because with the PROven® system suction is provided by the negative pressure in the single collector main.

- Leaks from oven doors, charging port lids, offtakes, and the gas collection main, which with the PROven® system will be lower than other byproduct coke oven batteries due to suction in the main and will be minimized through diligent operating and maintenance practices, including prompt luting of lids and offtakes, and effective cleaning of door jambs and seals after pushing. Door leaks will also be controlled by employing the FLEXZED® door design that employs flexible seals, which provide improved gas tightness relative to conventional types of metal door seals. In addition, fugitive emissions minimization will be enhanced by employing Uhde's CONTROLPRESS battery bracing system, which enables the required pre-stressing and gas tightness of the refractory walls of the ovens under varying operating conditions, and the FLEXZED® design flexible seals that provide gas tightness for oven doors.

Relatively little information concerning the controls applied to coke oven battery fugitive emissions were found in the USEPA's BID, RBLC, California BACT Clearinghouse, and other literature obtained by U.S. Steel and ENSR. The most notable findings were as follows:

- For byproduct recovery coke oven batteries, the only fugitive emissions addressed are visible emissions.

- The only emissions control measures identified for fugitive emissions for any byproduct recovery coke oven battery are work practice requirements.

- To minimize charging fugitive emissions, many of the byproduct recovery coke ovens employ stage charging, a screw feed discharge mechanism, and automatic lid lifting. Several of the batteries are subject to limits on visible emissions for each charge and for consecutive charges.

A mobile capture and control unit is not technically feasible for this application because it is considered unlikely that a mobile capture and control unit employing a scrubber can meet the applicable ACHD emissions standards. A mobile capture and control unit offers the advantage of being able to capture and control traveling emissions, but this advantage will be outweighed by the superior overall capture and control efficiency and cost-effectiveness of the Coke Transfer Car that is proposed for C Battery. In fact, since it will capture emissions that escape when the oven doors are opened for pushing, the Coke Transfer Car will greatly reduce the fugitive emissions capture advantage of a coke-side shed. The mobile capture and control unit technology, equipped with scrubbers (referred to commonly as mobile scrubber cars), has been employed at other coke oven batteries owned and operated by U.S. Steel, and (as indicated above) at other batteries as well. According to pages 3-9 of the USEPA's BID, "mobile scrubber cars were popular in the 1970s but have for the most part been replaced by stationary systems." The reasons for this, as explained on pages 3-10 and 3-11 of USEPA's BID, included the high cost of operation and maintenance, the requirement of a heavy track to support the combined weight of the quench car and scrubber car, the creation of scrubber effluents that require treatment (in contrast to alternatives such as a baghouse where such is not created), limitation on accessibility for maintenance due to the need to mount equipment on mobile scrubber cars close together, and maintenance requirements associated with the diesel engine that is required to propel the gas cleaning car.

A traveling hood attached to a fixed duct is technically feasible for this application. Fixed duct systems involve either a belt-sealed duct or a dampered port mechanism employed to focus the vacuum to the moveable hood. No information was found that indicated any particular advantage of either option. However, according to page 3-4 of the USEPA's BID, the belt-sealed duct system "has emerged as the most functional and widely accepted method of controlling pushing emissions worldwide." Experience has also shown that the dampered hood systems are more adversely affected by distortion from the heat of the pushes (especially green pushes). That causes more spotting & sealing problems (and/or more maintenance and downtime) than with the belt-sealed systems.

An SO_2 scrubber is technically feasible for this application. A number of design options could be considered for this application, e.g., either a packed bed or spray tower could be used, and either sodium or calcium hydroxide could be used for scrubbing. The configuration that would most likely be employed would be to install the SO_2 scrubber following the PEC baghouse. However, this type of arrangement is not known to have been either applied, attempted, or even studied for a coke oven battery pushing emissions control system. The full scope of technical issues that may be associated with this type of arrangement is therefore completely unknown. Also, the amount of SO_2 emissions released to the atmosphere during pushing are minimal. Although a scrubber would offer the advantage of combined SO_2 and particulate matter emissions control, this option was rejected because, considering the relatively small amount of SO_2 emitted during pushing (as compared to TSP, PM_{10}, and $PM_{2.5}$), it would not be cost-effective and would have associated environmental and energy impacts that would not be merited considering the relatively small reductions it would achieve in emissions.

3.2.2   BACT Determination for C Battery PEC System

Based on the information presented in Section 3.2.1, one of the key attributes of the proposed C Battery PEC system will be the Coke Transfer Car, which will be the first of its kind to be installed in the United States. This will reduce fugitive emissions during pushing by combining the functions of the coke-side door machine, coke guide, and pushing emissions capture hood. This makes it feasible to control the coke-side emissions from the time the oven door is removed until the push is complete and the quench car begins the traveling step. In addition, the Coke Transfer Car represents an improvement in safety controls for workers versus a coke-side shed. TSP, PM_{10} and $PM_{2.5}$ emissions will be minimized primarily through the PEC capture system and the PEC baghouse. The PEC capture system will achieve a capture efficiency of 90%, which is the maximum efficiency that is technically feasible for this type of system. The control efficiency of the PEC baghouse will be more than 99%, equivalent to the highest efficiency

PM controlled is approximately 92 tons/year and the cost is approximately $210,000 per ton of SO_2 and PM emissions controlled. The cost for this system is not economically feasible.

3.1.2 BACT Determination for Coking Cycle COG Combustion

Based on the above discussion and the BACT analysis contained in the Installation Permit Application for C Battery, BACT for Coking Cycle COG Combustion is the use of clean COG, the PROven® system and staged air combustion. Clean COG meeting the sulfur compound concentration requirement contained in §2105.21.h.2 will result in lower emissions SO_2, TSP, PM_{10} and $PM_{2.5}$. Application of the PROven® system will significantly reduce emissions of VOCs, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$ due to oven to flue leakage of raw coke oven gas. Staged air combustion will reduce NO_x, CO and VOC emissions.

3.2 BACT for C Battery Coke Pushing

According to information contained in the Background Information Document (BID) for Coke Ovens: Pushing, Quenching, and Battery Stacks; U. S. EPAs RACT, BACT, LAER Clearinghouse (RBLC), California BACT Clearinghouse and other information referred to in U. S. Steel's Installation Permit Application relative to pushing emission control (PEC) systems, the byproduct recovery and non-recovery coke oven batteries in the United States are equipped with one of the following systems:

- A shed enclosure vented to a control device;
- A mobile capture and control unit; and
- A traveling capture hood attached to a fixed duct venting to a control unit.

For all of these batteries, either a baghouse or a wet scrubber is employed to control captured pushing emissions.

3.2.1 Technically Feasible Pushing Emission Control (PEC) Systems

A coke-side shed is technically feasible for this application. A coke-side shed offers the advantage of capturing not only pushing emissions but all of the coke-side fugitives, notably door leaks, which are not captured by conventional PEC capture hoods. However, a shed requires a significantly larger air handling system and control device. A shed is also not capable of as high a level of capture efficiency as are either of the other two pushing emissions capture system options, and therefore a shed is both much more costly and less cost-effective overall than either of the other two options. The achievable capture efficiency for a shed is limited. A major factor that limits the achievable capture efficiency for a shed is that the shed must have at least one open end to allow the quench car to travel to and from the quench tower. In addition to lower emissions capture, the experience with the shed installed on the Clairton Plant B Battery indicates several other significant drawbacks for this option. First, the costs for the coke-side shed are much higher than the costs for a traveling hood attached to a fixed duct. A second drawback (in addition to the limited achievable capture efficiency) for a coke-side shed that is known based on the experience with B Battery is that the maintenance requirements associated with a shed are more extensive than with either of the other two options. Third, the higher maintenance requirements for the shed result in much higher operating costs for B Battery than are experienced for the other batteries at the Clairton Plant that employ a traveling hood/fixed duct system. Fourth, although the B Battery baghouse is significantly larger than the control devices employed on the other batteries, it is the only device that has experienced failures in compliance demonstrations.

flue gas desulfurization (FGD), selective catalytic reduction (SCR), selective non-catalytic reduction (SNDR), oxidation catalyst (OC) or other specific technology such as the PROven® system.

Emissions of all pollutants will be minimized through the employment of the PROven® system, combined with effective operating and maintenance procedures. The PROven® system will be especially effective in minimizing oven-to-flue leakage of raw coke oven gas, thus reducing emissions of VOCs, CO, SO_2, TSP, PM_{10} and $PM_{2.5}$.

NO_x emissions will be minimized through the employment of a combination of three technologies:

- PROven® system;
- Removal of nitrogen containing compounds in the COG by the byproduct recovery system; and
- Staging of combustion air in the heating flues.

The Clairton Plant byproduct recovery system includes a unique cryogenic process that is extremely efficient in removing nitrogen-bearing organic compounds such as pyridine, and a desulfurization process that includes an "HCN Destruct" unit to remove HCN, from the COG. The Clairton byproduct plant has a record of both high reliability and high efficiency.

The staged combustion system will be similar to an overfire air (OFA) system employed for NO_x emissions minimization in large-sized boilers. Excess oxygen in the combustion zone will be minimized by feeding part of the combustion air to the bottom of the heating flues, resulting in a first stage of combustion in a fuel-rich environment. Combustion will be completed through five (5) air ports located at different levels along the height of the flue. This will enable proper vertical wall temperature distribution together with reduced NO_x levels in the waste gas.

VOC and CO emissions will be minimized through the employment of the PROven® system in combination with the staged air combustion system.

SO_2 emissions will be minimized through the PROven® system (especially its effectiveness in minimizing oven-to-flue leakage) and the removal of sulfur from COG in the byproduct plant. Because the byproduct plant is designed to recover sulfur to yield a saleable product, the Clairton process is designed to achieve the highest feasible levels of sulfur removal from the COG. The byproduct plant sulfur removal process yields an average hydrogen sulfide (H_2S) concentration of approximately 10 grains per 100 dry cubic feet (gr/100 dcf) in COG used as fuel for the coke oven heating flues. As noted above, the Clairton byproduct plant has a record of both high reliability and high efficiency.

TSP, PM_{10} and $PM_{2.5}$ emissions, which are largely attributable to the presence of sulfur compounds in the COG being burned, will also be minimized through the PROven® system (especially its effectiveness in minimizing oven-to-flue leakage) and removal of sulfur from COG in the byproduct plant.

In addition to staged air combustion to reduce NO_x emissions, other control measures such as Selective Catalytic Reduction (SCR), Selective Noncatalytic Reduction (SNCR), XONON (a catalytic combustion system) and $SCONO_x$ (post combustion NO_x emission control) were all found to be technically infeasible. Except for SCR, these technologies have not been applied to coke battery combustion stacks in the U. S. or elsewhere. SCR was applied on a demonstration level basis between 1976 and 1992 at one facility in Japan but is not known to have progressed beyond the demonstration level of development for a coke oven application. COG with an H_2S concentration of 10 grains/ 100 dcf contains approximately 40 times the sulfur content of natural gas. The sulfur in the clean COG will foul and degrade the SCR catalyst. SNCR is not technically feasible because the exhaust gases must be reheated from a temperature of approximately 450°F to at least 1500°F. This would result in a significant energy and economic penalty. XONON and $SCONO_x$ have been designed for specific applications which did not include coke battery combustion stacks. The total capital cost (O&M plus the fixed cost) of installing and operating a lime spray dryer to control SO_2 and PM emissions was estimated to be $19.3 million. The total SO_2 and

A key component in the control of emissions from C Battery, as discussed in the BACT analysis submitted by U. S. Steel, is the PROven® (Pressure Regulated Oven) system. The PROven® system was developed by Uhde Corporation and they are also U. S. Steel's engineer for the C Battery project. The following is a brief discussion of the collector main and oven pressure during the coking cycle in by product coke oven batteries not equipped with the PROven® system and the operation of C Battery with the PROven® system. According to §2101.02.b, "Pollution prevention is recognized as the preferred strategy (over pollution control) for reducing risk to air resources. Accordingly, pollution prevention measures will be integrated into air pollution control programs wherever possible, and the adoption by sources of cost-effective compliance strategies, will be encouraged." The PROven® system is an excellent example of a "pollution prevention" strategy because maintaining the oven at a low positive pressure throughout the coking cycle prevents or greatly reduces emissions during coal charging, and from oven doors, offtakes, collector main and the combustion stack.

In conventionally operated coke oven batteries, the pressure inside each oven chamber of a battery changes individually during the coking cycle. The oven must be kept at a positive pressure to prevent the ingress of air which causes damage to the ovens. The collector main(s) are also kept under positive pressure. At the start of the coking cycle (charging and a few hours after charging), the high rate of raw coke oven gas evolution tends to increase the oven chamber pressure. Higher pressure inside the oven increases the possibility for leaks of raw coke oven gas through any weak points in oven sealing, especially around the oven doors. High oven pressure may also cause raw coke oven gas to leak into the heating flues resulting in increased emissions from the combustion stack. Ideally, the oven pressure should be kept low and constant throughout the coking cycle so as to avoid air ingress into the oven and also to avoid emissions.

The PROven® system maintains a negative pressure (suction) in the collector main and the pressure in each individual oven is maintained at a low and relatively constant positive pressure throughout the coking cycle. This pressure behavior in the individual ovens results in almost emission-free operation for the oven doors, charging ports and standpipes during the whole coking process. A more detailed explanation of the design and function of the PROven® system is provided in Appendix B.

3.1 BACT for C Battery Coking Cycle COG Combustion

The heat required to carbonize coal in the coke ovens is supplied by the desulfurized coke oven gas. As required by Article XXI, §2105.21.h.2, the concentration of sulfur compounds, measured as hydrogen sulfide, shall be less than or equal to 10 grains per hundred dry cubic feet (dcf) of coke oven gas. The concentration of sulfur compounds shall include tail-gas sulfur, measured as hydrogen sulfide, emitted from sulfur removal equipment.

All of the desulfurized coke oven gas (COG) produced at the Clairton Works is used to underfire the coke batteries and in other emission units at the Clairton, Edgar Thomson and Irvin plants. Use of another fuel to underfire C Battery, such as natural gas, which has a lower sulfur content, will not result in any emission reductions because this will result in an excess of COG. This excess COG will have to be flared. Therefore, fuel switching which may lower emissions of some pollutants from C Battery, will actually result in an overall increase in pollutant emissions from U. S. Steel's Mon Valley plants.

3.1.1   Proposed C Battery Coking Cycle Combustion Emissions Control Technologies

According to information contained in the Background Information Document (BID)[2] for Coke Ovens: Pushing, Quenching, and Battery Stacks; U. S. EPAs RACT, BACT, LAER Clearinghouse (RBLC), and the California BACT Clearinghouse relative to coking cycle COG combustion, no emission control technologies for reducing COG combustion emissions were identified. More specifically, no other coke battery in the U. S. was found that employs either an electrostatic precipitator (ESP), baghouse, scrubber,

Nonattainment New Source Review pollutants ; therefore, this project will net out of PSD and Nonattainment New Source Review.

3.0   REVIEW OF BEST AVAILABLE CONTROL TECHNOLOGY (BACT) ANALYSIS

According to Article XXI , §2101.20 Definitions: "Best Available Control Technology" *means an emission limitation based on the maximum degree of reduction of each air contaminant regulated by this Article, which the Department determines on a case-by-case basis to be achievable taking into account the energy, environment, and economic impacts and other costs. In no event shall application of BACT result in emissions of any air contaminant exceeding the emissions allowed under any applicable New Source Performance Standard (NSPS), any National Emission Standard for Hazardous Air Pollutants (NESHAP), or any Reasonably Available Control Technology (RACT) emission limit under this Article.*
"Lowest Achievable Emission Rate" *means that emission rate which is the most stringent of:*

a.   The most stringent emission limitation contained in any state's implementation plan approved by the EPA for such class or category of source, unless the applicant demonstrates that such limitation is not achievable;

b.   The lowest emission rate achieved in practice by such class or category of source; or,

c.   Any applicable NSPS established by the EPA.

As applied to a modified source, LAER means the lowest achievable emission rate for the new or modified emissions units within the source.

If control technology can feasibly be transferred from one type of source to another, both types of sources shall be considered of the same class or category for purposes of determining LAER.

In accordance with the above BACT definition and U.S. EPA and ACHD guidance, the Installation Permit Application submitted by U. S. Steel Corporation, BACT was determined through a "top-down" assessment that started with the Lowest Achievable Emission Rate (LAER) and proceeded through consideration of progressively lesser levels of control. Separate assessments were made for each emissions unit subject to BACT, and each pollutant subject to BACT was considered separately except for particulate matter (TSP, PM_{10}, and $PM_{2.5}$).

The emission units that are included in the Installation Permit and the BACT analysis include:

1. C Battery Coking Cycle COG Combustion (NO_X, VOCs, CO, SO_2, TSP, PM_{10} & $PM_{2.5}$)

2. C Battery Coke Pushing (NO_X, VOCs, CO, SO_2, TSP, PM_{10} & $PM_{2.5}$)

3. C Battery Fugitive Emissions (NO_X, VOCs, CO, SO_2, TSP, PM_{10} & $PM_{2.5}$)
   o Coal Charging
   o Oven Door Leaks
   o Offtake Leaks
   o Collector Main Leaks

4. C Battery Traveling (NO_X, VOCs, CO, SO_2, TSP, PM_{10} & $PM_{2.5}$)

5. C Battery Quench Tower (VOCs, SO_2, TSP, PM_{10} & $PM_{2.5}$)

6. C Battery Coke Handling (TSP, PM_{10} & $PM_{2.5}$)

Table 4
Baseline Actual Emissions for Batteries 7, 8 & 9

PROCESS	NO$_X$	SO$_2$	VOC	PM Total (filterable + condensible)	PM$_{10}$ Total (filterable + condensible)	PM$_{2.5}$ Total (filterable + condensible)	CO
	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Pre-Push Emissions	0.176	0.623	0.113	11.949	6.174	5.775	0.140
Pushing Fugitives (without Hood)	0.2	1.3	1.0	5.9	3.2	2.0	0.8
PEC Baghouse	13.5	50.5	3.1	15.2	7.2	3.5	33.9
Traveling Hot Car	10.9	40.6		23.2	8.7	3.2	8.7
PEC Fugitives (with Hood)	1.7	6.4	29.8	172.0	95.3	59.1	23.0
Quenching		10.4	35.5	367.1	297.0	226.9	
Combustion Stacks	1035.0	102.4	6.7	95.8	91.2	89.5	418.0
Ball Mill				0.015	0.015	0.015	
Soaking	0.6	60.9	3.7	9.2			11.2
Decarbonization							715.6
Battery Fugitives							
Doors			6.8	5.5			3.4
Lids			0.0	0.01			0.01
Charging			0.4	0.4			0.2
Offtakes			0.2	0.2			0.1
Coal Handling				31.4	13.7	13.1	
Coke Handling				13.1	6.2	5.7	
Total	1062.2	273.0	87.3	750.9	528.8	408.8	1215.0

Table 5
PSD and Nonattainment New Source Review Applicability Analysis

Pollutant	C Battery Emission Increases	Battery 7, 8 & 9 Emission Decreases	Net Emission Change	PSD Significant Threshold	PSD Applicability	NA NSR Significant Threshold	NA NSR Applicability
	tons/yr	tons/yr	tons/yr	tons/yr		tons/yr	
NO$_X$	485.0	1062.2	-577.2	25	NO	40	NO
SO$_2$	226.7	273.0	-46.4	40	NO	N/A	N/A
VOC	76.5	87.3	-10.7	N/A	N/A	40	NO
TSP	367.9	750.9	-382.9	N/A	N/A	25	NO
PM$_{10}$	239.9	528.8	-288.8	15	NO	N/A	N/A
PM$_{2.5}$	197.3	408.8	-211.4	N/A	N/A	10	NO
CO	1108.1	1215.0	-106.9	100	NO	N/A	N/A
Lead	0.012	0.012	0.00	0.6	NO	N/A	N/A
H2S	148.291	277.289	-129.0	10	NO	N/A	N/A
TRS	151.945	300.767	-148.8	10	NO	N/A	N/A

The increase in pollutant emissions due to the operation of C Battery (Table 3) and the emissions decreases due to the shutdown of Batteries 7, 8 & 9 (Table 4) result in a net emissions decrease. The summary of the netting analysis presented in Table 5 indicates a net reduction in emissions of all PSD and

Table 3
Potential Emissions from the Operation of C Battery

PROCESS	NOx	SO₂	VOC	PM Total (filterable + condensible)	PM₁₀ Total (filterable + condensible)	PM₂.₅ Total (filterable + condensible)	CO
	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr	tons/yr
Pre-Push Emissions	0.006	0.023	0.001	12.87	6.65	6.22	0.004
Pushing Fugitives (without Hood)	0.2	0.8	0.6	3.6	2.0	1.2	0.5
PEC Baghouse	15.9	59.5	1.2	33.5	14.9	6.1	38.2
Traveling Hot Car	6.4	24.1		13.8	5.2	1.9	5.2
PEC Fugitives (with Hood)	0.9	3.5	20.4	119.1	65.8	40.7	16.2
Quenching		12.8	43.9	108.3	105.5	102.8	
Combustion Stack	461.2	91.9	5.0	17.3	16.8	16.6	351.7
Ball Mill				0.017	0.017	0.017	
Soaking	0.3	34.1	2.1	5.2			2.89
Decarbonization							
Battery Fugitives							
Doors			2.6	2.2			1.3
Lids			0.1	0.1			0.04
Charging			0.5	0.4			0.2
Offtakes			0.1	0.1			0.1
Coal Handling				35.3	15.4	14.7	
Coke Handling				16.1	7.6	7.0	
Total	485.0	226.7	76.5	367.9	239.9	197.3	1108.1

The AP-42 procedures provide estimates of the Benzene Soluble Organics (BSO) emission rates for doors, lids, offtakes and charging. Emissions of other pollutants were estimated by the ratio of the pollutant to the BSO emission rate as presented in AP-42, Table 12.2-4. The BSO emission rates are presented in Appendix A, Tables C1-13 and C1-16(i & ii) and C3-1.

2.4 Netting Analysis for the C Battery Project

The emission calculations presented in Appendix A provide the basis for determining the potential emission increases associated with the operation of C Battery and the emission decreases resulting from the shutdown of Batteries 7, 8 & 9. C Battery emissions increases are presented in Table 3, emission decreases from Batteries 7, 8 & 9 are presented in Table 4 and the emissions netting analysis is presented in Table 5.

Soaking refers to emissions directed to the atmosphere for a short period of time when the oven is disconnected from the collector main just before the doors are removed in preparation of the push. At this time the standpipe caps are opened to the atmosphere and any coal that is not fully carbonized (green coke) will ignite and the emissions will be released to the atmosphere. With the PROven® System, the occurrence of green coke should be greatly reduced. Soaking emissions are presented in Appendix A, Table C1-11.

Decarbonization Emissions
Decarbonization emissions occur after the coke is pushed from the oven and the doors are replaced. The standpipe lids are open and the oven is left empty for 20-30 minutes to burn off excess carbon from the oven walls, roof and floor. A more detailed discussion of decarbonization emissions is presented in Appendix A13. Emission calculations are presented in Appendix A, Tables C1-12 and C2-1.

Coal Handling Emissions
Coal handling involves the transfer of coal from barges or trucks onto several conveyor belts which in turn transfer the coal into mixing bins or surge bins where the coal is stored until needed in the process. Coal is transported from the surge bins into pulverizers where it is pulverized to a pre-selected size after which it is blended with a wetting agent (oil or water) to regulate the bulk density of the mixture. This mixture is stored in bunkers until a larry car picks up a specific mass (or volume) of the mixture before charging it to the ovens. There will be a slight increase in coal handling emissions due to the increase in coal charged to C battery over that presently charged to Batteries 7, 8 & 9. Coal handling emissions are presented in Appendix A, Table C1-14.

Coke Handling Emissions
Quenched coke is transferred from the coke wharf to one of three screening stations. No. 1 Screening Station receives coke from Batteries 1 - 3 and 7 - 9, No. 2 Screening Station receives coke from Batteries 13-15 and 19 & 20, and No. 3 Screening Station receives coke from B Battery. No. 1 Screening Station will receive coke from Batteries 1 - 3 only as Batteries 7 – 9 will no longer be in use. Before the startup of C Battery, No. 3 Screening station will be replaced with a new screening station that will serve Batteries B, C and D. If a new screening station is to be installed, the permittee will be required to submit a separate installation permit application for the anticipated new coke screening station. Coke handling emissions are presented in Appendix A, Table C1-15.

Coking Process Fugitive Emissions
Fugitive emissions during coking result from charging, offtakes, door and lid leaks. Soaking and decarbonization emissions are also included in the totals for the coking process fugitive emissions.

With the installation of C Battery and the PROven® system, the leaks from doors and lids, emissions from soaking due to poor seal between the oven and collector main, and offtake leaks will be minimized since the emissions will be conveyed to the collector main which is maintained at a negative pressure.

For Batteries 7, 8 & 9, fugitive emissions from door, lid and offtake leaks and charging emissions are based on the Method 303 observations for the baseline period and the emission estimating procedures provided in AP-42 Draft, Section 12.2.2.-1, July, 2007. This AP-42 equation for estimating the BSO emission rate for door, lid and offtake leaks contains a term for the door leak rate for doors without visible leaks. This term was not used in estimating door leaks for Batteries 7, 8 & 9. The same methods are used for C Battery except that the allowable number of lid leaks and visible charging emissions are provided in 40 CFR Part 63, §63.304(b)(4)(ii & iv). Based on information provided in the installation permit application, it was estimated that the PROven® system will reduce visible door leaks and offtake leaks by 39%.
The MACT Standards in §63.309(b)(4) regarding the percent leaking coke oven doors, topside port lids and offtake systems have been reduced by 50%, 60% and 40%, respectively based on the expected performance of the PROven® system. Therefore, BACT for C Battery is 2.0 percent leaking doors, 0.15 percent leaking topside port lids and 1.5 percent leaking offtake systems.

were revised as necessary. The spreadsheets, tables and discussions in Appendix C of the Application are included in Appendix A of this document.

The following paragraphs present a brief discussion of the emissions associated with the operation of Batteries 7, 8 & 9 and C Battery, including the pushing emission control systems, quench towers and coal and coke handling systems.

Coke Battery Pre-Push Emissions
Pre-push emissions occur when the coke side oven door is removed prior to pushing the coke and terminate when the coke side door is replaced. Emissions generated are due to exposure of the hot coke to the atmosphere, evaporation of tar from the door jamb and the coke side door gas channel, sealing edges and plug. More detailed discussions of these emissions are presented in Appendix C11 and Tables C1-3 and C11-1.

Coke Pushing Fugitive Emissions
Pushing fugitives emissions occur when the pushing emission control (PEC) hood system is out of service due to routine maintenance or a breakdown and the emissions that are generated when the coke side door is removed and the coke is pushed (see Table C1-4). Fugitive emissions also occur when the PEC hood does not capture all the emissions that are generated during the pushing cycle (see Tables C1-4 and C1-7).

The emission factors in AP-42[1] for fugitive pushing emissions also include the emissions that are generated by the incandescent coke being loaded into the hot car and traveling to the quench tower. Because C Battery contains larger ovens, the number of pushes needed to produce the same quantity of coke is significantly less and the travel distance to the C Battery quench tower is also less than the distance traveled by the Battery 7, 8 & 9 hot car to Quench Tower 3. Therefore, travel emissions are less for C Battery. In order to account for this reduction in travel emissions, the AP-42 emission factors for fugitive pushing emissions were modified by eliminating travel emissions. A more detailed explanation of fugitive pushing and travel emissions are presented in Appendix A7 and A14-1.

Pushing Emission Control (PEC) Baghouse Emissions
PEC baghouse emissions are those emissions captured by the PEC hood and ducted to the baghouse. These emissions are presented in Appendix A, Table C1-5.

Ball Mill Emissions
Dust collected in the PEC baghouse is transferred to a hopper and then is transferred offsite. Although these emissions are referred to as ball mill emissions, the emissions are generated when the baghouse dust drops into the hopper. These emissions are presented in Appendix A, Table C1-10.

Coke Battery Quench Tower Emissions
Quenching the incandescent coke with water generates primarily particulate emissions. The quench towers are equipped with baffles that control these emissions. The C Battery quench tower will be taller than the tower serving Batteries 7, 8 & 9 (Quench Tower 3) and it will contain two sets of baffles. Emissions from this new quench tower will be significantly less than Quench Tower 3. Quench tower emissions are presented in Appendix A, Table C1-8.

Coke Battery Combustion Stack Emissions
Emissions from the combustion stacks are due to the combustion of desulfurized coke oven gas (COG) and the leakage of raw COG from the oven into the heating flues. Leakage of raw COG in C Battery is likely to be significantly less than in Batteries 7, 8 & 9 due to the battery being new and installation of the PROven® System that will maintain a lower pressure inside the oven. Also, less COG is required to produce a ton of coke inC Batterythan in Batteries 7, 8 & 9. Combustion stack emissions are contained in Appendix A, Table C1-9.

Soaking Emissions

Emission reductions due to the shutdown of Batteries 7, 8 & 9 are based on baseline actual emissions. According to 25 Pa Code § 127.203a. Applicability (a) (4) (i) which states that

"for an existing emissions unit, baseline actual emissions are the average rate, in TPY, at which the unit emitted the regulated NSR pollutant during a consecutive 24-month period selected by the owner or operator within the 5-year period immediately prior to the date a complete plan approval(i.e., installation permit) application is received by the Department. The Department may approve the use of a different consecutive 24-month period within the last 10 years upon a written determination that it is more representative of normal source operation."

U.S. Steel (USS) submitted their installation permit application on January 2, 2008. The Department deemed the application complete on January 23, 2008; therefore, the 5-year look back period would begin January 23, 2003 and end January 22, 2008. USS requested to use a 24-month period beginning May 1, 2002 and ending April 30, 2004. A total of 9 months in this period is prior to the 5-year look back period that begins January 23, 2003. USS requested a different 24-month period because:

- Coal deliveries were interrupted from December 2003 through February, 2004 and again from December 2004 through February 2005, causing a shortage of coal on site, thus limiting the amount of coal that could be charged to the batteries. Batteries 1 - 3 and 7 – 9 were particularly affected.

- Batteries 7 - 9 are now taking 20-22 hours to produce higher stability coke rather than the design 18 hour period. The longer coking times are required in order to meet customer requirements. C Battery would be able to produce the same higher quality coke in 18 hours. The longer overall coking times in 7 -9 Batteries result in lower coke production than desired.

- The number of ovens available for coke production has been decreasing due to oven conditions and increased oven refractory maintenance.

The Department approved the use of the 24-month baseline period beginning May 1, 2002 and ending April 30, 2004. Table 2 presents the annual average production statistics during this 24-month period.

Table 2
Annual Average Production for Batteries 7, 8 & 9 for the Baseline Period (5/1/02 – 4/30/04)

No. of Ovens	192
Coal Charged (tons/year)	1,229,551
Coke Produced (tons/year))	896,421
Coal Charge per Oven (tons)	15.7
Coke Produced per Oven (tons)	10.5
Pushes per day	238.6
Coke Oven Gas Consumption for Underfiring (mmcf/yr)	6,690
Coke Oven Gas Consumption for Underfiring (mmBtu/yr)	2,997,120
Coke Oven Gas Heating Value (Btu/cu. ft.)	448

2.3.3   Description of Emission Sources

The production rates and other information contained in Tables 1 and 2 were used to calculate pollutant emissions for the netting analysis. Emission reductions will be realized from the shutdown of Batteries 7, 8 & 9 and Quench Tower No. 3 and emission increases will result from the operation of the proposed new C Battery, C Battery Quench Tower and emission increases associated with the small increases in coal and coke handling. The emission factors and emission calculations presented in Appendix C of the Installation Permit Application for the Proposed C Battery Project (Application) were reviewed by the Department and discussed with USS and their consultant(s). Based on these discussions, the spreadsheets, tables and discussions in Appendix C as well as other tables and discussions elsewhere in the Application

- pushing (PEC Baghouse, PEC fugitives, uncontrolled pushing)

- travel to the quench tower and,

- combustion stack

2. C Battery Quench Tower

Some of the future allowable emissions have been provided by Uhde Corporation, the design and construction firm on this project. However, Uhde Corporation was not able to provide guaranteed emission rates for all segments of the process; therefore, stack test data, AP-42 emissions factors [1] and USS engineering judgment was used where guarantees could not be provided.

Potential emissions are based on C Battery operating at its maximum capacity. As provided in the permit application, these maximum capacities are presented in Table 1:

Table 1
Maximum Capacities for C Battery

No. of Ovens	84
Coal Charged (tons/year)	1,379,059
Coke Produced (tons/year))	1,107,384
Coal Charge per Oven (tons)	36.8 tons
Coke Produced per Oven (tons)	24.7
Pushes per day	116
Coke Oven Gas Consumption for Underfiring (mmcf/yr)	6,123.2
Coke Oven Gas Consumption for Underfiring (mmBtu/yr)	2,743,193.6
Coke Oven Gas Heating Value (Btu/cu. ft.)	448

2.3.2   Baseline Actual Emissions
The following existing equipment will be shutdown:

Coke Oven Batteries 7, 8 & 9 which includes the following emission sources:

- Coal charging, including coal bunker and conveyors

- Coking

  o Doors

  o lids,

  o offtakes,

  o decarbonization,

- soaking

- pushing (PEC Baghouse, PEC fugitives, uncontrolled pushing)

- travel to the quench tower and,

- combustion stack

Batteries 7, 8 & 9 Quench Tower (Quench Tower 3)

As presented below, the shutdown of existing Batteries 7, 8 & 9 and the startup and operation of C Battery will result in an overall decrease in both criteria and hazardous air pollutant emissions. According to §127.203a(a)(1), "*If the project causes a significant emissions increase, the project is a major modification if it also results in a significant net emissions increase.*" This Section presents an analysis demonstrating NSR non-applicability for the proposed C Battery Project only. Project design for the D Battery project has not advanced to the point where a non-applicability analysis can be performed. United States Steel recognizes the possibility that splitting the non-applicability analysis could be interpreted as segmentation in order to avoid triggering NSR. Each project separately or as an aggregate will provide a net emission decrease and not trigger NSR.

2.2   Overview of Emissions Netting Procedures

In assessing PSD applicability the procedures in 40 CFR 52, §52.21 and in assessing NNSR applicability, the procedures described in PADEP's Pennsylvania Code, Subchapter E, §127.203a were followed:

1. Calculate the future allowable emissions for the new units; if the future emissions from the new units exceed PSD and /or NNSR significance levels, then

2. Calculate baseline actual emissions for existing units affected by the C Battery Project, that is, existing units that will be shut down and units whose emissions will increase or decrease, and

3. Calculate contemporaneous emission changes associated with minor source permits;

4. Subtract emissions calculated in steps 2. and 3. from those in step 1. to determine the net emissions change resulting from the Project. If the difference is less than the PSD and NNSR significance limits, the project is considered a minor modification and PSD and NNSR will not apply.

2.3 Calculating Future Allowable Emissions from New Equipment and Baseline Actual Emissions for Batteries 7, 8 & 9

The Project will involve the shutdown of Batteries 7, 8, and 9 and the startup of C Battery. During the time period between the phased shutdown of Batteries 7, 8 & 9 and the startup and full operation of C Battery there will be no increase in actual emissions. The schedule for this shutdown and startup plan is presented in Section 5.0

2.3.1   Future Allowable Emissions

The following new equipment will be installed:

1. Coke Oven Battery "C" which includes the following emission sources:

- Coal charging

- Coking

  o Doors

  o lids,

  o offtakes,

  o decarbonization,

- soaking

(exit area = 774.7 ft^2 and height = 131.5 feet above grade) will serve as the auxiliary tower for quenching the coke from C Battery.

1.2   Coke Handling

After being quenched with water, coke is discharged onto an inclined surface called the coke wharf which allows for the drainage of excess water. The heat transfer during this time also brings the coke to a lower temperature making it safe to handle. After this, the coke is transported via conveyors to a screening station where it is segregated based on size. The blast furnace coke will be dropped into rail cars and the coke breeze will be dropped into trucks. Since the conveyors that transfer the coke to the screening station are covered and the screening station is enclosed, emissions of pollutants are collected and controlled. The coke breeze loadout emissions will be captured by a dedicated dust capture hood.

2.0   PREVENTION OF SIGNIFICANT DETERIORATION AND NON-ATTAINMENT NEW SOURCE REVIEW APPLICABILITY ANALYSIS

2.1   Regulatory Background

Allegheny County is designated as attaining the National Ambient Air Quality Standards (NAAQS) for SO_2, PM_{10}, CO and NO_2 and non-attaining for $PM_{2.5}$ and ozone. The pollutant SO_2 is considered a precursor of $PM_{2.5}$ and is likely to be treated as a non-attaining pollutant under forthcoming $PM_{2.5}$ regulations. Similarly VOC is a precursor for ozone. NO_x is considered a precursor for both $PM_{2.5}$ and ozone. Both VOC and NO_x are likely to be treated as non-attainment pollutants for purposes of major new source review.

The Prevention of Significant Deterioration (PSD) regulations apply to new major sources and major modifications located in areas that are attaining the NAAQS. The PSD requirements as promulgated in 40 CFR §52.21 have been adopted by the Department in their entirety per §2102.07.a. As a coke battery, the Clairton Works is one of the twenty-eight major source categories listed in the PSD regulations (40 CFR 52.21). Existing potential emissions from this facility exceed 100 tons per year for at least one pollutant. Therefore, the coke plant is a major source. For the C Battery Project to be a major modification, that is, for it to undergo PSD review, the net change in emissions due to the Project plus other contemporaneous increases and decreases in actual emissions would have to exceed PSD significance levels for at least one pollutant. With the shutdown of Batteries 7, 8 & 9 there will be a net decrease in facility-wide emissions due to the project for attaining pollutants (SO_2, NO_2, PM_{10} and CO).

Final rules for implementing the $PM_{2.5}$ regulations for New Source Review in nonattainment areas (NNSR) were promulgated on May 16, 2008, with an effective date of July 15, 2008. While the project is not subject to the new rule because a complete permit application was submitted to ACHD prior to July 15, 2008, the project would still net out of NSR/PSD even under the new implementation rule for PM2.5. According to §2102.06.a.4, under its nonattainment NSR permit regulations, Article XXI requires that, "Except as otherwise specifically provided under this Section, this Section shall be applied consistent with the provisions of the state regulation for New Source Review Applicability Determination promulgated under the Air Pollution Control Act at 25 PA Code §127.211 which is hereby incorporated by reference into this Article." In May 2007, 25 PA Code §127.211 was moved to 25 PA Code §127.203a.

In this project, NNSR applicability analysis for $PM_{2.5}$ will be done in two ways: Alternative 1 will assume that PM_{10} is the surrogate for $PM_{2.5}$ and Alternative 2 will assume that the plant's direct emissions of $PM_{2.5}$ and its precursors NO_x and SO_2 are accounted for in determining NNSR applicability.

With the installation of C battery and the PROven® system, the leaks from doors and lids, emissions from soaking due to poor seal between the oven and collector main, and offtake leaks will be minimized since the emissions will be conveyed to the collector main which is maintained at a negative pressure.

C Battery will also be equipped with the FLEXZED® coke oven doors. The FLEXZED® sealing system can be adjusted to varying door body and chamber frame contours while maintaining the compressive forces of the sealing strip onto the chamber frame along the entire door circumference. The FLEXZED® system will significantly reduce door emissions and prevent ingress of air into the oven chamber.

1.1.3 Coke Pushing

Coke pushing begins when the coke side oven door is removed and ends when the hot car enters the quench tower. During the push, gases are drawn from the coke side door and hot car into the hood where they are channeled to the exhaust duct and then to a baghouse. The Pushing Emission Control (PEC) system on C Battery will consist of a hood that is integral to the door machine. Whenever a coke side oven door is opened, there will be a hood to capture emissions, thus reducing pushing fugitive emissions. The hood's capture efficiency is guaranteed at 90%, which is greater than the capture efficiency on the existing coke oven batteries using a similar PEC system. The PEC baghouse will have an outlet grain loading of 0.005 gr/dscf.

1.1.4 Travel

After receiving the hot coke, the hot car travels to the quench tower. During travel the hot car is uncovered. Emissions to the atmosphere consist mainly of particulate released as part of the hot air rising from the coke in the car. Smaller amounts of SO_2, NOx, CO and other pollutants are also released. For C Battery, there will be a new hot car and quench tower. Hot car travel-related emissions will be lower than those from Batteries 7, 8 & 9 for the following reasons:

- There will be fewer trips traveling to the quench tower. Travel distance to the C Battery quench tower will be less, resulting in fewer trip miles per year.

- The C Battery hot car will be larger than the hot car used for Batteries 7, 8 & 9. The coke in the larger C Battery hot car will have greater surface area exposed to the atmosphere, thus higher emissions per car. However, the larger hot car will have a smaller surface area to volume ratio, thus emitting less pollutant per volume or per ton of coke in the hot car. The net effect is lower annual emissions from C Battery traveling.

1.1   Quench Tower

Incandescent coke, after it is pushed from the ovens, is transported by means of a quench car or hot car to a quench tower. Quenching of coke minimizes it from burning from further exposure to air. As part of the C Battery Replacement Project, the quench tower for Batteries 7, 8 & 9 will be shut down along with the B battery auxiliary quench tower which will be demolished. A new quench tower will be installed for the C Battery. This new quench tower will also serve as the auxiliary quench tower for the B Battery. This new quench tower will have an exit area of 1406.1 ft² and will have a height of 164.2 feet above grade. It will have two sets of Kiro-Nathaus baffles installed within it which are more efficient at capturing the entrained water droplets than the baffles in the quench tower currently being used by Batteries 7, 8 & 9 . In addition to the new quench tower, the C Battery system will employ a new quench car to transport the coke from C Battery to the new quench tower.

The quench sump for C Battery will be larger than Batteries 7-9 quench sump for better settling and thus cleaner water. It will also have a rake to remove the settled solids. The B Battery quench tower

1.0 PROCESS DESCRIPTIONS AND EMISSION CONTROLS:

1.1 Coke Oven C Battery

By-product coke ovens are designed and operated to permit collection of the volatile material evolved from coal during the coking process. C Battery will contain 84 ovens. Coal is charged through openings in the top of the ovens and during the coking cycle, refractory-lined doors seal both ends of each oven. Approximately one pound of recycled coke plant materials (tar decanter sludge, bio sludge, coke oven gas pipeline material, metallurgical coke, petroleum coke, coke breeze, synfuel, synfuel additive and bulk density control additives) are added to each ton of coal prior to charging the coal to the oven. Combustion chambers on each side of the coking chamber (oven) consist of a large number of flues which permit uniform heating of the entire length of the coking chamber. To permit escape of the volatile matter driven from the coal during coking, an opening is provided at the top of the oven. Each opening is fitted with an offtake pipe, which connects the oven with the gas collecting main. The coking cycle normally takes between 16 to 18 hours. After the coking cycle is completed, a pusher ram pushes the incandescent coke into a quench car. The quench car is moved to the quench tower where a stationary array of water spays cool the incandescent coke. The quenched coke is then dumped on the coke wharf.

Pollutant emissions from the coke batteries are controlled by pollution control equipment, and maintenance and other work practices that minimize fugitive emissions. These work practices and/or emission control practices include:

1.1.1 Coal Charging

C Battery will utilize a screw feed larry car that will allow for more controlled charging of coal into the ovens. Larry cars receive coal from coal storage bins and discharge a measured volume of coal to the oven. They move along rails on top of the battery. Charging emissions are expected to decrease as a result of the use of the screw feed larry car and the Pressure Regulated Oven PROven®system installed on the gas offtake of each oven. The PROven® system is an electronic control system that individually controls the pressure in each individual oven depending on the stage of coking that each oven is experiencing. The collector main is also maintained at a negative pressure to draw the off gases released during charging and coking thus reducing emissions. The high spikes in oven pressure currently experienced in the existing batteries will be greatly reduced in C Battery.
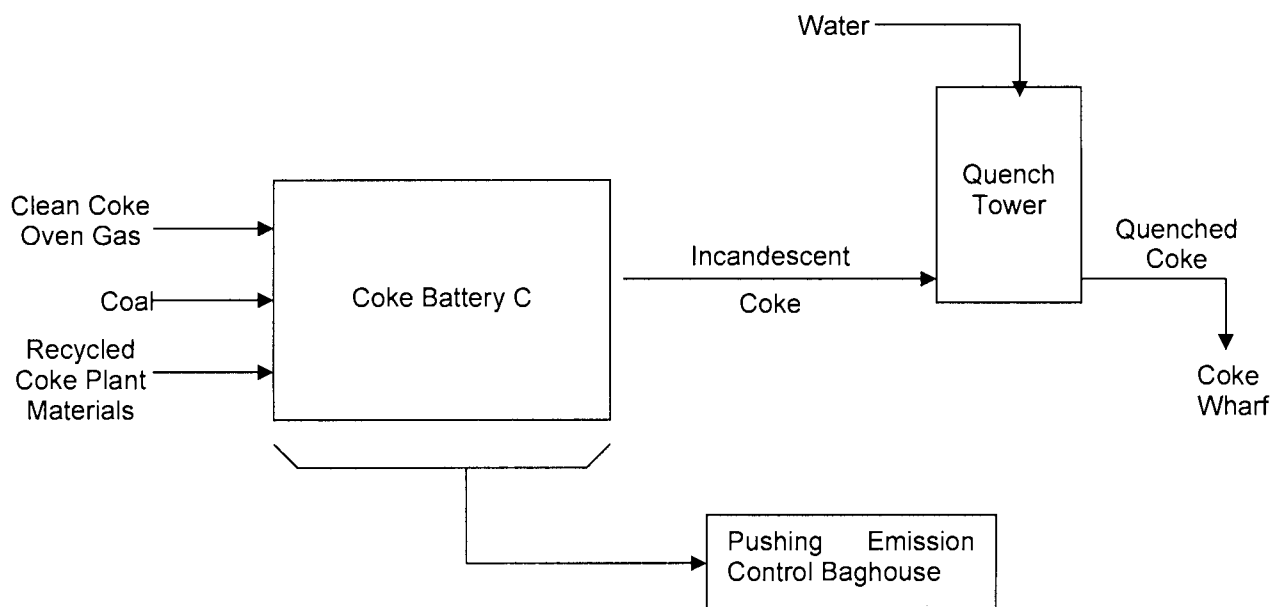
1.1.2 Coking Process

Once the ovens have been charged with coal, the coking process begins. The walls of the ovens contain heating flues, of which half burn COG and the other half transport the residual heat from the combustion flues to a heat exchanger called a regenerator. The waste gases coming out of the heat exchanger are discharged from the combustion stack. The destructive distillation of coal produces raw coke oven gas, which is cleaned and used as a fuel in the heating flues. To prevent the entry of air into the oven during coking, a slight positive pressure is maintained in the oven. The by products of coking (gases) are carried through the offtake system to the collector main and then to the byproduct recovery plant. Any volatiles contained in the bulk density additives or other recycled coke plant materials are also carried to the byproducts plant. At the conclusion of the coking cycle, the doors are removed and the incandescent coke is pushed by a ram into the hot car.

Atmospheric emissions during coking result from fugitive emissions (charging, offtake, door and lid leaks) and from the combustion stack. Emissions from soaking and decarbonization are included in the totals for the coking process as well. Soaking refers to emissions directed to the atmosphere for a short period when the oven is disconnected from the collector main just before the doors are removed in preparation of the push, i.e., the standpipe caps are opened to the atmosphere. Coke that is still "green" would emit pollutants to the atmosphere through the stand pipes. Decarbonization emissions occur after pushing and after the doors have been replaced. The lids are kept cracked or off and the oven left empty for 20-30 minutes to burn off excess wall or roof carbon.

COKE C Battery PROCESS FLOW DIAGRAM

Clean Coke
Oven Gas →

Coal → **Coke Battery C** → Incandescent Coke → Water → **Quench Tower** → Quenched Coke → Coke Wharf

Recycled
Coke Plant →
Materials

→ **Pushing Emission Control Baghouse**

The new C Battery will be located adjacent to and south of existing B Battery. C Battery will utilize new coal unloading, handling and conveying equipment. However, emissions associated with the coal handling as they relate to C Battery have been included in the C Battery permit, permit application and netting analysis. Coke produced from C Battery will be sent to a new coke screening station for rail car loading and offsite transport. In addition to C Battery, this new coke screening station will be utilized by other batteries at Clairton. If a new screening station is to be installed, the permittee will be required to submit a separate installation permit application for the anticipated new coke screening station. .

The Pushing Emission Control (PEC) system on C Battery will consist of a moveable hood with a stationary baghouse. The moveable hood is integral to the door machine, thus reducing pushing fugitive emissions. Whenever a door is opened, there will be a hood on the coke-side of the oven to capture emissions. The capture efficiency of the hood is guaranteed at 90%, thus also reducing PEC system fugitive emissions. The PEC baghouse will have a particulate outlet loading of 0.005 grains per dry standard cubic foot (dscf).

As part of the C Battery Replacement Project, the quench tower now serving Batteries 7, 8 & 9 will be shut down along with B Battery auxiliary quench tower which will be demolished. A new quench tower will be installed for C Battery. This new quench tower will also serve as the auxiliary quench tower for B Battery. This new quench tower will have an exit area of 1,406.1 ft^2 and will have a height of 164.2 feet above grade. The new tower will be taller and will provide more draft than the existing tower for Batteries 7, 8 & 9. It will also be equipped with a dual baffle system (Kiro-Nathaus baffles) which are more efficient at capturing the entrained water droplets than the single baffle system in the quench tower currently being used by Batteries 7, 8 & 9. In addition to the new quench tower, the C Battery will employ a new quench car to transport the coke from C battery to the new quench tower. The existing B Battery quench tower will serve as the auxiliary tower for quenching the coke from C Battery.

Installation Emission Unit Summary:

I.D.	SOURCE DESCRIPTION	CONTROL DEVICE(S)	MAXIMUM CAPACITY	FUEL/RAW MATERIAL	STACK I.D.
P046	Coke Oven C Battery	PROven® System Pushing Emission Control System Baghouse	1,379,059 tons of coal charged per year	Coal, supplemented with recycled coke plant materials such as tar decanter sludge, bio sludge, and coke oven gas pipeline material, synfuel, metallurgical coke, petroleum coke, coke breeze, synfuel additive and bulk density control additives; Coke Oven Gas	S046 (Combustion Stack) and S047 (PEC Baghouse Stack)
P047	C Battery Quench Tower	Kiro-Nathaus Baffles (2 sets)	1,379,059 tons of coal per year	Incandescent Coke, Water	S048

ALLEGHENY COUNTY HEALTH DEPARTMENT
AIR QUALITY PROGRAM

July 24, 2008

SUBJECT: U. S. Steel Clairton Works
Installation Permit: No. 0052-I011

This permit is for the installation of a Coke Oven Battery with a Pushing Emission Control System and Quench Tower

TO: Sandra L. Etzel
Chief Engineer

FROM: Thomas M. Heron
Air Quality Engineer

FACILITY DESCRIPTION

U.S. Steel Clairton Works is the largest by-products coke plant in North America. Clairton Works operates 12 coke batteries and produces approximately 13,000 tons of coke per day from the destructive distillation (carbonization) of more than 18,000 tons of coal. During the carbonization process, approximately 225 million cubic feet of coke oven gas are produced. The volatile products of coal contained in the coke oven gas are recovered in the by-products plant. In addition to the coke oven gas, daily production of these by-products include 145,000 gallons of crude coal tar, 55,000 gallons of light oil, 35 tons of elemental sulfur, and 50 tons of anhydrous ammonia.

Clairton Works is located approximately 20 miles south of Pittsburgh on 392 acres along 3.3 miles of the west bank of the Monongahela River. The plant was built by St Clair Steel Company in 1901 and bought by U.S. Steel in 1904. The first coke batteries were built in 1918. The coke produced is used in the blast furnace operations in the production of molten iron for steel making.

INSTALLATION DESCRIPTION

United States Steel (USS) is proposing two projects that will replace some of the old coke oven batteries with new batteries. In the first project, which is the subject of this Installation Permit, a new C Battery will replace existing Batteries 7, 8 and 9. In the second project a new D Battery, (subject of a separate permit application) will replace Batteries 1, 2 and 3. The new batteries will contain the latest emission control technology and will emit less air pollution per ton of coke produced than the old batteries. C Battery will have 84 ovens (6 meters in height x 18 inches wide x 16.7 meters in length) that will have a design production rate of 36.8 tons of coal charged per oven for a design coking time of 18 hours to produce 24.7 tons of blast furnace coke per oven. The expected annual coke production from this new battery will be 1,107,384 tons. Batteries 7, 8 & 9 have a total of 192 ovens with a current production capacity of approximately 896,420 tons of coke per year. USS will install the PROven® system, developed by Uhde Corporation. The PROven® system (Pressure Regulated Oven) regulates pressure within each oven chamber where the collector main operates under a negative pressure during coking in order to significantly reduce fugitive emissions from the ovens during charging and coking. The coking process will be more efficient and will require 11% less coke oven gas to be burned per ton of coke produced. NO_X emissions will be minimized through the employment of a staged combustion system.